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THE IMPACT OF INFORMATION TECHNOLOGY ON BUSINESS ORGANISATIONS OF THE FUTURE

by

René Pellissier

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*'There is a theory that states that, if ever anyone discovers exactly what the Universe is for and why it is here, it will instantly disappear and be replaced by something even more bizarre and inexplicable.
There is another theory which states that this has already happened.'*

Douglas Adams,1980: 7-8

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EXECUTIVE SUMMARY

THE IMPACT OF INFORMATION TECHNOLOGY ON BUSINESS ORGANISATIONS OF THE FUTURE

RENÉ PELLISSIER

SUPERVISOR:	PROFESSOR PS KRUGER
DEPARTMENT:	DEPARTMENT OF INDUSTRIAL AND SYSTEMS ENGINEERING, FACULTY OF ENGINEERING, UNIVERSITY OF PRETORIA.
DEGREE:	PHILOSOPHIAE DOCTOR

The world and society at large are experiencing profound changes that bring about their own challenges and opportunities but also demand of businesses to align their business strategies and processes with their technology strategies, as IT is probably the most significant driving force and enabler of change. Since the evolution of technology is so rapid, this in itself induces and (at the same time) impedes radical change. IT has opened up new opportunities such as presented by evolving digital commerce. Globalisation of business reflects the view that businesses will compete in a borderless environment that demands flexibility and quick response rates. However, evolutionary processes are employed to attain revolutionary change. This anomaly highlights the need for re-engineering existing and past paradigms and methodologies. Re-engineering's successes/failures are measured against the rapidly expanding world of IT.

Newton's linear science and the clock-like machine universe it presupposes, is being replaced by dynamic forces so powerful to change forever the paradigms of the past. Thus, the study of chaos theory and its replacement by the concept of a *chaordic theory*.

The focus in the thesis is Handy's age of unreason, or period of discontinuity, called the "Quantum Era" in which the microchip, technology and information are identified as the main agents of change. The notion of radical change for businesses (and society at large) is explored using Tichy's Revolutionary Change Model, which depicts organisational revolution as a drama in three acts: *The Awakening* (realising the need for change), *The Envisioning* (creating the vision) and *The Re-architecting* (**the birth of a wholly new organisation – the *chaordic enterprise***).

An eclectic strategy was followed drawing from and integrating principles from a vast and varied field of knowledge, covering the natural, social and business sciences and philosophy (e.g. Mathematics, Mathematical Statistics, Quantum theory and the Management Sciences). The thesis adds the following to the existing body of knowledge:

- The proposition of *de-engineering* (and *chaos engineering*) the corporation, following from the principles of self-organisation (-renewal), strange attractors and feedback in chaos theory to rectify re-engineering's deficiencies. Chaordic theory replacing chaos theory in the business sciences.
- *Technology Change Model* whereby organisations can measure the scope of the change (incremental or discontinuous) against (information) technology (existing or new)
- The proposition of
  - appropriate mathematical business models that follow the natural life cycle of any business or idea and
  - the subsequent identification (mathematically and statistically) of the time (pro-active or pre-active) to institute radical change points ('cusps' or 'bifurcations' in chaotic or catastrophic systems).

- Evaluation of IT/IS projects in terms of:
  - an *information delivery matrix* – measuring the direct and indirect consequences and showing evolutionary application of IT
  - the application of the traditional total cost of ownership [TCO] model, the development of a generic TCO-based model for its implementation and possible integration into the supply chain paradigm and
  - a return on investment IT (ROIT) –perspective.

Throughout the thesis, three phenomena become prevalent. These are:

- **The self-organising, self-renewal principles of a chaotic system. Ultimately, some (new) point of equilibrium is reached, introducing the notion of a *chaord* (= cha-os + ord-er).**
- **The inherent cyclical trends prevalent in society and organisations, that, though the needs of society and the environment have shifted into a new paradigm, these trends resemble their predecessors albeit in a mutant form or different Gestalt, similar to Kondratieff's (K-) waves.**
- **The synchronicity of research across a multitude of boundaries.**

In conclusion, the possible effects of the chaordic organisational form and leadership on the broader society and on the macro-level is explored. Although the evolution of this field is so rapid as to make obsolete any proposition of what the future may hold, an attempt is made to identify possible future scenarios.

I hereby submit this thesis as my own and original work. May the reader gain from it the same gratification this researcher did in researching the topic.

René Pellissier
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René Pellissier June 1999

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SAMEVATTING

DIE IMPAK VAN INLIGTINGSTEGNOLOGIE OP DIE BESIGHEIDSORGANISASIES VAN DIE TOEKOMS

RENÉ PELLISSIER

PROMOTOR: PROFESSOR PS KRUGER

DEPARTEMENT: DEPARTEMENT BEDRYFS- EN SISTEEMINGENIEURSWESE, FAKULTEIT INGENIEURSWESE, UNIVERSITEIT VAN PRETORIA.

GRAAD: PHILOSOPHIAE DOCTOR.

Die wêreld staan in die midde van radikale veranderinge wat hul eie uitdaginge en geleenthede meebring maar terselfdertyd van ondernemings vereis dat hulle hul besigheidstrategieë en -prosesse behoorlik in pas bring met hul inligtingstegnologie strategieë, synde dat laasgenoemde na alle waarskynlikheid die mees beduidende dryfkrag en bemagtigingsagent vir verandering is. Die snelheid waarmee tegnologie verander, bevorder èn inhibeer radikale verandering. Die suksess en mislukkings van herontwerp word dus ondersoek en gekoppel aan inligtingstegnologie.

Die tradisionele Newtoniaanse siening van die wêreld in lineêre terme van oorsaak-en-gevolg waarin gebeure soos die ratte van 'n masjien inmekaarskakel, word toenemend ontoereikend om as analoog te dien vir die tegno-sosiale kragte wat op die moderne samelewing inwerk. Gevestigde paradigmas word onomkeerbaar irrelevant. Die proefskrif fokus dus op chaosteorie, en meer spesfiek word dit vervang met die begrip *chaordiese* teorie.

Die fokus van hierdie proefskif is Handy se tydvlak van arasionaliteit ['*age of unreason*'], of 'tydvlak van diskontinuïteit' ['*period of discontinuity'*], of oorgangsfase, die Kwantum Era, waarin die mikroskyf, tegnologie en inligting geëien word as die hoofdrywers van die verandering. Die idee van radikale verandering van sake-ondernemings (en die breë samelewing) word ondersoek

deur die lens van Tichy se *Revolutionary Change Model*. Tichy karakteriseer organisatoriese rewolusie (en samelewingverandering) as 'n besondere soort drama wat in drie dele ontplooi word: *Die Ontwaking* (die behoefte aan verandering word besef), *Die Vooruitsigstelling* ('n visie word geskep), en *Die Her-argitektering* (ontwerp en opbou van 'n totaal nuwe organisasie).

Deur die wiskundige wetenskappe, die sosiale en die bestuurswetenskappe en die filosofie te integreer (Wiskunde, Wiskundige Statistiek, Kwantumfisika en die Bestuurswetenskappe), lewer hierdie proefskrif 'n besondere bydrae ten opsigte van die volgende:

- Die ontwikkeling van die begrip *de-enginieurswese* (of *chaos-ingenieurswese*) as uitbouing van die beginsels van self-organisasie (-vernuwing), onverwagte en spontane, endogene valensiepatrone, en -iterasies ontleen van chaosteorie en die toepassing daarvan om die tekortkominge van herontwerp aan te spreek.
- *Tegnologieveranderingsmodel* ['Technology Change Model'] waarmee ondernemings die koppeling tussen suksesvolle herontwerp (radikaal of inkrementeel) en toepaslike inligtingstegnologie (nuut of bestaande) kan evalueer.
- Die ontwikkeling van:
  - Wiskundige besigheidsmodelle wat die kromme vir Handy se konstrukte van die lewenssiklusse van idees of ondernemings weergee en
  - Die daaruitvolgende bepaling van die tydstip vir radikale verandering (pro-aktief of pre-aktief) (wiskundig en statisties). Hierdie punte word genoem die 'cusp' of 'bifurcation'-punte in chaos- of katastrofeteorie.

- Die evaluasie van IT/IS-projekte in terme van:
  - 'n *Inligtingsoordragmatriks* waarmee direkte en indirekte gevolge gemeet kan word – veral in terme van die evolusie van inligtingstegnologie-implementerings
  - Die toepassing van die koste van eienaarskap ['Total cost of ownership', TCO]-beginsel op IT-projekte, die ontwikkeling van 'n TCO-gebaseerde

generiese model en die implementering van laasgenoemde op 'supply chain management' en

- 'n 'Return on investment IT' [ROIT] perspektief.

(Inligtings)-tegnologie het baie nuwe sakegeleenthede moontlik gemaak, soos byvoorbeeld die ontluikende digitale besigheidsparadigma. Die globalisering van sakebedrywighede weerspieël die siening dat ondernemings in 'n grenslose omgewing met mekaar moet meeding wat buigsaamheid en vinnige responskoerse sal vereis. Desnieteenstaande maak ondernemings meestal van evolusionêre prosesse gebruik ten einde revolusionêre veranderinge in produkte en dienste te weeg te bring. Hierdie anomalie beklemtoon die behoefte aan de-enginieurswese (chaos ingenieurswese), wat op die grondslae van self-organisering en self-vernuwing (ontleen aan chaosteorie) berus. Te meer nog, dikwels bestaan daar op dieselfde tydstip meerdere heersende bestuursparadigmas, sommige waarvan volkome onversoenbaar is met, en onbestaanbaar is, naas die chaotiese dimensies van die nuwe ondernemingsvorm, naamlik die 'chaordic' onderneming.

Drie verskynsels word meerdermale vasgelê:

- **Die beginsel van self-ordende en self-vernuwende stelsels ontleen aan chaos- en kompleksiteitsteorie wat daartoe aanleiding gee dat 'n nuwe ewewigspunt bereik word. Die begrip 'chaord' word ingelei.**
- **Die herhalende aard (siklisiteit) van samelewings en ondernemings. Selfs indien die samelewing en die omgewing na 'n nuwe paradigma beweeg, die behoeftes in wese 'n gelyksoortigheid openbaar ten spyte van die paradigmaskuif, soortgelyk aan Kondratieff se K-golwe.**
- **Die sinchronisiteit van navorsing oor meerdere grense.**

Die mate van verandering word bespreek as uitbreiding van die samelewings- en ondernemingsvlak met die kompeterende wapen van inligting en inligtingstegnologie as nuwe medium. Desnieteenstaande uitbreiding in hierdie veld so geweldig is dat dit enige voorstel verouderd stel, word 'n poging aangewend om toekomstige scenarios vir ondernemings daar te stel.

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Hiermee word hierdie proefskrif as my eie oorspronklike werk. aangebied Mag die leser daaruit soveel waarde haal as die navorser met die ondersoek van die studie.

DEDICATION

As always, with love to
Jeanri, Mellet and Dominique –
for there is no greater honour than knowing you and no greater pleasure
than being your mother.

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I could not have done this without support from:

- The Creator of all things, the Owner of all knowledge
- The greatest mathematicians, Isaac Newton, Bertrand Russel and Stephen Hawking – whose discoveries move the frontiers of science and our own thinking.
- Professor Paul Kruger for his specific knowledge, his general wisdom and his time – and the challenge of trying to beat his logic and his humour
- Marius van Wyk who introduced me to the great philosophers of the world
- Librarians, Lorraine Grobler and Megan Scheepers, for keeping me up to date on the relevant literature
- Sarie Klopper and Rose Purchase, who took it upon themselves to provide stability and order, where I had chaos

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ACT III
INSTITUTIONALISING CHANGE

LIST OF ABBREVIATIONS

4GL	Fourth-Generation Language
ACPA	ABRUPT CHANGE POINT ANALYSIS
AMOC	At most one change point
BPM	Business process management
BPR	Business Process Re-engineering
DB	Database
DBMS	Database Management Systems
DSS	Decision Support Systems
EAM	Enterprise Asset Management
EDI	Electronic Data Interchange
EIS	Executive Information Systems
ERM	Enterprise Resource Management
ERP	Enterprise Resource Planning
ESS	Executive Support System
EVA	Economic Value Added
HTML	Hypertext Markup Language
HTTP	Hypertext Transfer Protocol
IS	Information Systems
IT	Information Technology
ITT	Information Technology and Telecommunications
JIT	Just in Time Principle
LAN	LOCAL AREA NETWORK
KWS	Knowledge Support System
MIS	Management Information Systems
NPV	Net Present Value
O AND M	Operations and management
OAS	Office Automation System

OCP	Out of context problem
OLAP	Online Architecture Platform
PC	Personal Computer
ROI	Return on Investment
ROIT	Return on Investment Information Technology
SAP	Software Applications Product
SVA	Shareholder value added
SWOT	Strengths, weaknesses, opportunities and threats
TCO	Total Cost of Ownership
TPC MODEL	Technical, political and cultural model
TPS	Transaction Processing System
TQM	Total quality management
VA	Value added
WAN	WIDE-AREA NETWORK
WWW	World Wide Web

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THE PROBLEM

*"It must be remembered that there is nothing more difficult to plan,
more uncertain of success, nor more dangerous to manage
than the creation of a new order of things.
For the initiator has the enmity of all who would benefit by the
preservation of the old institutions, and merely lukewarm defenders in those who
would gain by the new ones."*

Machiavelli, The Prince

Since its inception in the early 1990s, much has been written about the notion of re-engineering - first by its creators, Hammer and Champy, and subsequently by those who tried to follow their teachings to attain the successes it promised. Has re-engineering delivered its promise of dramatic improvements in terms of cost, quality, service and speed?

The answer to this, is two-fold. Firstly, it concerns the inherent flaws in Hammer and Champy's own definition of re-engineering proposed in 1990. It has even been claimed to have Marxist (revolutionary) origins. They [Hammer and Champy] themselves have seen fit to change the original definition, claiming that the concept was largely deemed to be a cost cutting methodology as opposed to one for strategic sustainable change – a re-engineering of re-engineering. Thus it is necessary to study the definition and consequences of re-engineering itself. Secondly, with rapidly advancing technology, re-engineering is largely driven by a new force, that of information and IT. Organisations that are getting the mix right between re-engineering their business processes and implementing the (sometimes costly) appropriate technologies to do so, have been successful. Organisations which have not achieved this, are bearing the costs of re-engineering without enjoying its advantages. For them (and it seems as if the vast majority of organisations that embark on re-engineering, fall into this category) there is a period of cleaning up after re-engineering.

This thesis will study the effect of advancing (information) technology on changing the organisation, its structures and its values, and the ways that it is doing business. Because technology changes the very nature of work, it changes the workers and it changes leadership and structures within organisations. More and more organisations are finding themselves re-engineering their ways of doing business more than re-engineering the processes – because technology is forcing them to do so. The challenge for organisations is to get this right and to know when it is time to implement radical change.

RESEARCH STRATEGY DEPLOYED

Since no research has meaning without proper validation, use is made throughout of a hybrid case study approach. The case study has long been stereotyped as a weak sibling among social science research methodologies. However, this inherently qualitative method has some distinct advantages, even to a mathematical statistician like oneself. To this researcher, the greatest advantage is the fact that it provides the opportunity to explore uninhibitedly, all dimensions of organisational life and IT's uses and abuses without the constraints that structured data modelling would have imposed.

Possible research strategies depend upon:

- The type of research question,
- the control over actual events by the researcher, and
- the focus on contemporary as opposed to historical phenomena.

These are summarised below - in no order of preference [Yin, 1989: 17].

Table 1: Summary of different research methodologies, indicating their usage

strategy	Form of research question	Requires control over behavioural events	Focuses on contemporary events
Experiment	How, Why	Yes	Yes
Survey	Who, What, Where, How many, How much	No	Yes
Archival analysis	Who, What, Where, How many, How much	No	Yes/No
History	How, Why	No	No
Case study	How, Why	No	Yes

Yin [1989: 23] defines the case study as

' .. *an empirical inquiry that*

- *investigates a contemporary phenomenon within its real-life context;*

- *when the boundaries between phenomenon and context are not clearly evident; and*
- *multiple sources of evidence are used.'*

In answering '*how?*' and '*why?*' questions, the case study strategy deals with operational links needing to be traced over time, rather than mere frequency or incidents. In the case of the current research, organisations are asked 'how' and 'why' questions in order to determine their use of relevant information technology and its relevance on radical change. In examining contemporary events, it is preferable to add two sources of evidence not generally included in the historian's repertoire. These are:

- Direct observation and
- systematic interviewing.

In this context, the case study's unique strength lies in its ability to deal with the full range of evidence – documents, artefacts, interviews and observations [Yin, 1989].

It is acknowledged that the case study has many disadvantages and may be deemed questionable by the pure scientist. It is suggested that this is largely due to bias on the part of the investigator, but, since it is also possible to introduce bias in designing questionnaires, it is contended that this will not detract from this research. Secondly, since there is no necessity for proper design of the experiment and a proper random sample is not necessary, generalisation may be questionable. This is even truer of the single case methodology. The answer to this is that case studies are generalisable to theoretical propositions and not to populations. Hence the case study, like an experiment, does not represent a statistical sample and the goal of the research is not to enumerate frequencies, but to expand and generalise theories. Thirdly, case studies may take too long and generate massive documentation. It is suggested here that this need not necessarily be the case, provided that the research remains structured and focused.

Use will be made in this thesis of multiple case studies rather than single case study methodology, the former being analogous to multiple experiments. Previously developed theory is used as a template from which to compare the empirical results from the case. If two or more cases support the same theory, replication may be claimed. Evidence from multiple cases is often considered more compelling and the overall study is thus regarded as being more robust [Yin, 1989]. There is no danger of the unusual or rare case becoming the norm. It should be noted that the full variety of qualitative and quantitative empirical sources of evidence is available. These sources of evidence include the following [Yin, 1989: 20]:

- Documentation,
- archival records,
- interviews,
- direct (and indirect) observation and
- participant observation.

By adopting the chosen research strategy, it was possible to validate (but not prove) the proposed Technology Change Model and information delivery matrix which form the core of this thesis and address the research problem.

It should be pointed out that, throughout this research, the author has endeavoured to put IT/IS-related issues in *strategic* (as opposed to *operational*) perspective. The researcher has found a culture of this nature to be lacking in the current literature and the business environment and can only hope that this thesis will enable business leaders to grasp the real strategic value of BPR and IT that are emerging.

In his exposition of scientific theory, Hawking [1988: 9] suggests that any good theory should satisfy the following two requirements. These are:

1. It must accurately describe a large class of observations on the basis of a model that contains only few arbitrary elements and
2. It must make definite predictions about the results of future observations.

According to him (Hawking) any physical theory is always provisional in the sense that it is only a hypothesis – one can never prove it. Thus, no matter how many times the results of subsequent experiments agree with the theory, one cannot predict whether the next time, the result may not contradict the theory. On the other hand, to disprove a theory, one only has to find a single observation contradicting the theory. Thus, a new theory really is an extension of the previous theory. In practice, a new theory may be devised following upon add-ons to the previous theory, through modifications or even abandonments. An example of such is that of Newton's laws of gravity, which in essence, have been proved not correct by Einstein's predictions. However, since Newton's laws are simple and the difference between its predictions and those of general relativity is very small, Newton's work stands. (In this thesis too, Newton's laws are used to prove a point and subsequently questioned as to their continued relevance in a changing world). The point here is that, although this researcher, in no way equates the propositions, definitions and models in this thesis to those of the great physicists, these (the propositions, definitions and models) generally also follow the principles of a good theory as postulated by Hawking, thus having (and adding) scientific value – and to which, until they are proven not appropriate through the intervention of a single contradiction, the theory may be extended and built upon by the reader.

Due to the extent of the research subject (i.e. the evolution of IT and its re-engineering of all levels of society) which is almost chaotic in nature, it is possible that parts of this research may initially seem without focus or intent. The researcher, however, feels that from the models derived (Module V) and the findings and conclusions in the Epilogue, it can be stated that, within such a complex system as this, there is order out of chaos and that the terms 'chaordic' (= chaos + order) used in Module II and the 'de-engineering' (the self-organising principle following from the aftermath of re-engineering) in Module V, have relevance in this research. The reader will also find that this researcher has deviated from the accustomed linear research methodologies in accordance with Newton's now (limitedly) flawed cause and effect thinking.

To return to Newton's case mentioned above, Russel [1992] points out that the traditional cause and effect model (that is the traditional Newtonian linear framework) described in Modules II and III is fundamentally erroneous, requiring to be replaced by a different notion, namely those of the laws of change. Much of modern business science (also in this thesis) are derived from the laws of nature – these, according to Russel, apparently being in a state of continuous change. Russel proposes an interesting scenario whereby cause and effect may be used, but both shortened indefinitely, resulting in, as embodiment of the causal law, a certain direction of change at each moment (Russel likens this to differential equations embodying causal laws). Since it is not possible to observe infinitesimals in time or in space

' .. rough empirical generalisations (in this thesis) have a definite place in science, in spite of not being exact or universal. They are the data for more exact laws, and the grounds for believing that they are usually true are usually stronger than the grounds for believing that the more exact laws are always true.'

Russel, 1992: 312

Russel [1992: 634] concludes

' ..it is plausible to suppose that every apparent law of nature which strikes us as reasonable, is not really a law of nature, but a concealed convention, plastered on to nature by our love of what we, in our arrogance, choose to consider rational.'

In embarking upon the above venture, one has deviated from one's accustomed paths - the experience has been enriching. After years spent in statistical consultations, one has reached a stage whereby one questions the subject's (Mathematical Statistics') ability to handle open-ended research and have started to realise that the subject, although obviously scientific by nature, lacks a certain open-endedness in that it generally focuses on strengths of some proposition *already known*, thus limiting the research to ask the how and why questions that this researcher thinks should form the basis of any research. The follow-up of this work, will certainly entail many fruitful quantitative research topics – some of which this researcher's students have already embarked upon. To this researcher, the chosen methodology proved stimulating and rewarding and follows the route suggested by Hawking and by Russel on the worth of any scientific theory.

It is hoped that the reader will find in this work something as valuable and challenging as the research strategy deployed was to the author, for whom as a former mathematical statistician, the greatest learning experience was probably this:

That there is knowledge to be gained and lessons to be learnt, and the source of it is nature and the human mind … And that there is only one way of proving them wrong – and that is after the fact.

'Execution is the chariot of genius'

William Blake

PROLOGUE

"Press on. Nothing in the world can take the place of persistence.
Talent will not - nothing in the world is more common than unsuccessful men with talent. Genius will not - unrewarded genius is a proverb.
Education will not - the world is full of educated derelicts.
Persistence and determination alone are omnipotent."

Calvin Coolidge

This thesis focuses on *radical* (or *revolutionary) change* – radical change through re-engineering the processes of the business (or the business itself) or radical change through the evolution of technology, especially IT. This being the case, the researcher chose to deploy Tichy's Revolutionary Change Model as a road map through the thesis (Figure 1).

According to Tichy [1993: 52]:

'The course of revolution is predictable ..
and its different phases can be understood.'

He (Tichy) maintains that an organisational revolution is a particular type of drama with protagonists, antagonists, dramatic themes and a gripping and deep plot played out in three acts: **The Awakening** (*when the need for change is realised*), **The Envisioning** (*when a vision is created and workers are mobilised*) and **The Re-architecting** (*which entails the design and construction of a wholly new organisation*). The protagonists of this drama are the people who seek to change and set the revolutionary plot in motion. The end of the transformation is exhilarating and leads to a feeling of rebirth, after which the process begins anew.

The Awakening phase focuses on the need for change, which is the most wrenching part of the revolution. The protagonists have to shatter the status quo and release the emotional energy needed for the revolution. This phase also deals with resistance to change (mainly technical, political and cultural). During the envisioning phase, the purpose of the revolution comes into focus. This process is creative but often chaotic. The Envisioning process should address three fundamental building blocks of the organisation, namely the technical (organising people, capital, information and technology to produce goods and services), political (power and rewards) and cultural (shared values and beliefs) aspects. The Re-architecting phase captures the art and challenge of creative redesign. It involves redesigning and rebuilding the organisation in order that it should become 'boundaryless' in that there is a free flow of information from where it is created to where it is needed. This notion of boundarylessness creates new organisational structures.

Tichy's model describes the process of organisational change in terms of several modules, set within these three Acts, pertaining to the different constituents of the change (Figure1) and according to which the chapter or module headings for the thesis were set. According to Tichy, there should be recognition of a need for change – this is studied in **Module I** (*Setting the scene*) in which an age of transition is assessed according to the new driving force behind change, in this instance, the advent of the microchip as the critical mass for change. Mention is made of the repetitive nature of phenomena, since this notion becomes critical in the Epilogue at the end. Thereafter, **Module II** (*Facing the reality*) studies the current realities of chaos and catastrophe and endeavours to identify, mathematically and statistically, that point in time, the cusp, where the change would still have pro-active (or pre-active or reactive) meaning.

With the advent of the New Age of information, and the subsequent move from the Industrial to the Digital Era, there is a need for new organisational structures and forms. Some of the organisational forms described in **Module III** (*The awakening*), may not be new, but their implementation certainly is. The notions of a 'chaord' and a 'chaordic enterprise' (following from the original contention of the 'quantum organisation') are suggested to handle the complexities identified in Module II. The principle of self-organisation as a consequence of the chaos studied in Module II, is derived. **Module IV** (*Envisioning*) touches on the organisation's new resources, namely information (and technology), business knowledge or business intelligence. Ways of acquiring these resources and creating and maintaining competitive advantage out of the intangible and dynamic medium they constitute, are explored. IT is defined from an evolutionary point of view rather than seen as a fixed state. IS and IT as (respectively) the demand and supply sides of information are discussed. Information delivery systems are identified and explored and a model for the classification of information delivery systems proposed. Since the main focus of attention in the thesis is the issue of re-engineering the business, the author has refrained from delving too deeply into the interesting phenomenon of knowledge management.

The thesis then progresses to the issue of re-engineering the business (or its processes) which is dealt with in **Module V** (*Re-architecting*). The focus is on the failures of re-engineering, rather than its successes and the possible reasons for these failures. They are, in part, ascribed to a lack of a culture of technology innovation, a lack of appreciation of the value of information and the evolution (from back room, cost cutting to strategic relevance) and cost of IT. It is contended that re-engineering is inextricably bound to the implementation of information delivery systems. A model studying the links between the two is proposed. Two methods for measuring the cost of IT are suggested, these being return on investment (ROIT) and total cost of ownership (TCO). Re-engineering as a business performance improvement tool is questioned, especially since the fathers of the concept of re-engineering, Hammer and Champy themselves, have, since its inception, concluded that there may have been good reason for its many failures - one possibly the advancement and rapid deployment of technology itself. A model (the Technology Change Model) integrating IT and BPR is proposed. The final focus in this Module is on the consequences of re-engineering, what this author terms, '*de-engineering* the corporation'.

Module VI focuses on the learning organisation, without which any change is meaningless, and studies new kinds of leadership, termed 'chaordic leadership' in accordance with the earlier themes.

The last **Module** (*Epilogue*) fittingly addresses the cyclical nature of society and the economic waves through which the world as we know it, has progressed. It questions the unexpected proposition that there might be few things new. That is, it questions the repetitive nature of the world despite the continuous advent of new technologies. It continues to explore the ideal state mentioned in **Module I** and originally conceived by the Greek philosopher, Plato. It also addresses the disappearance of national and ethnic boundaries, reminding one strongly of the way in which the concept of digital business has crossed the normal boundaries and barriers of current businesses in and between organisations.

In this author's view, this aspect best highlights the radicality of the changes needed in our (business) society – that, from Toffler's and Kondratieff's waves and Imperato and Harari's epochs (which will be explained in Module I), nothing can remain the same and that the world as we know it, is on the verge of another jump onto a curve, of which the dependent variable may be known, but the independent variables of the new function are too complex to properly and quantitatively identify.

Using Tichy's model, one has tried to determine these, each Module identifying and describing an independent variable from that new curve, but not even having the power, as yet, to weigh these in terms of relative importance. According to the theory, a system that is in a state of chaos is bound to reach some new point of equilibrium, but the time and format are unknown. Thus, Tichy's model serves only as a road map for a course, and the world may possibly as yet only have an inkling of its outcome. Moreover, *where* (and *what*) that point of equilibrium will be, we simply do not know. More interestingly, how *long* that equilibrium will last, is also unknown – especially if we take cognisance of the fact that Toffler's first wave lasted more than 8000 years, whereas the second lasted a mere 300 years...

The choice of Tichy's model is deemed appropriate in the light of the fact that re-engineering is revolutionary in nature (see the reflections on re-engineering and Marxism in **Module V**) and IT is generally revolutionising the ways in which organisations are competing through information and knowledge.

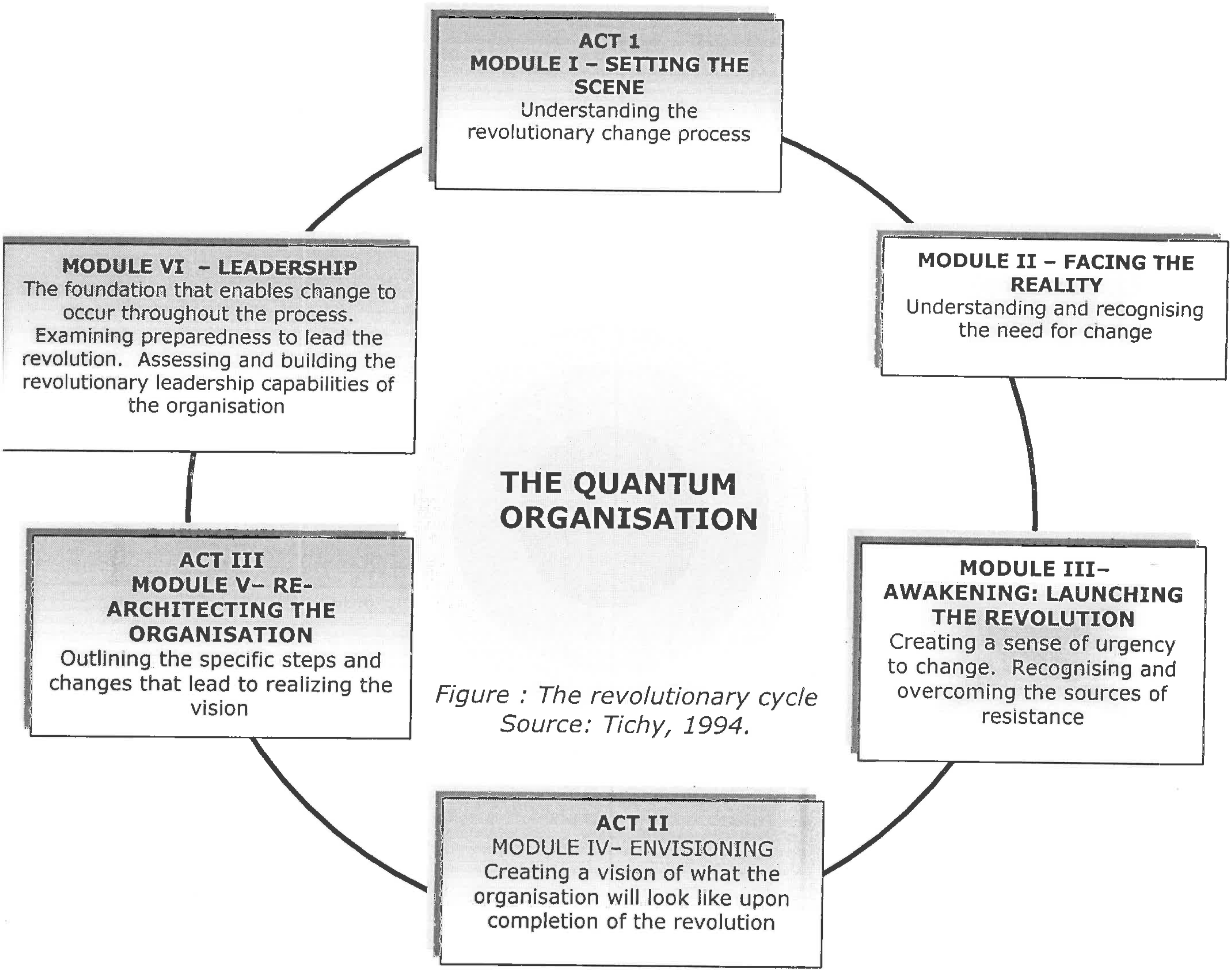


Figure 1: Use of Tichy's model as a road map through the thesis
After Tichy, 1993

The reader will (rightly) question the references used in the thesis, finding some 'dated', even more so within the field under review, namely information and IT. The reality is that the evolution of our knowledge on organisations with respect to the emerging technologies is expanding so rapidly that few publications, and even fewer text books, are up to date in this field. It has been this author's challenge and pleasure to use and update the present knowledge base and present or change it in such a way as to make it applicable within this dynamic new world. As a consequence, most definitions, graphical presentations and tables summarising concepts, have no formal references as these simply do not exist – yet. One has to borrow and derive concepts from the fields of organisational strategy and systems theory, from traditional Industrial Engineering and from Economics – all of which lend themselves fairly well to describing the new power of information. A good example of this is that of the definition of IT which this author subsequently elected to link to its evolution rather than remain with rigid definitions on their own.

Another example is that of the concept of re-engineering presented by Hammer and Champy themselves. Since its inception in 1990, this subject itself has undergone major re-engineering (even more so, in terms of Hammer and Champy's glib reference to IT 'as an enabler'). What IT was in 1990 when they opted to use it as an enabler and what IT is today (or could possibly become in the future), are simply not comparable at all – and probably justify and support the re-engineering failures cited in literature.

Moreover, it is this author's contention that, to any business problem two parallel and (arguably) equally important solutions exist, one being a short-term (operational solution) and the other a long-term (strategic) one. The short-term one is necessary to sustain the organisation while the more strategic solution takes time to have its effect on the organisation's survival. One has purposely elected the more strategic one as it is this author's belief that IT has and should have that effect for the organisation of the future to survive.

The underlying principle of all society's endeavours is the creation of a (perceived) ideal state. Whether this takes the form of value creation or stakeholder value for organisations, this principle is universal to human nature. For this reason, it is felt that Plato's *The Republic*, has relevance to any academic work of this kind, hence the quotations introducing every Module and also the final quotation at the end. The fact that Plato's driving force was the death of his friend and mentor, Socrates and the way in which this was orchestrated, has parallels in the current dissatisfaction with the world and the driving force of technology taking us into a digital era – what this author likes to call the 'Quantum Age', after Max Planck's quantum hypothesis, whereby *'a quantum may disturb a particle and change its velocity in a way that cannot be predicted'* [Hawking, 1988: 54], giving credence to the central notion of chaos theory as foundation in this thesis. Plato's work (and its hypothetised relevance) also enhances the notion made here that there is evidence of repetition in our drive for competitiveness.

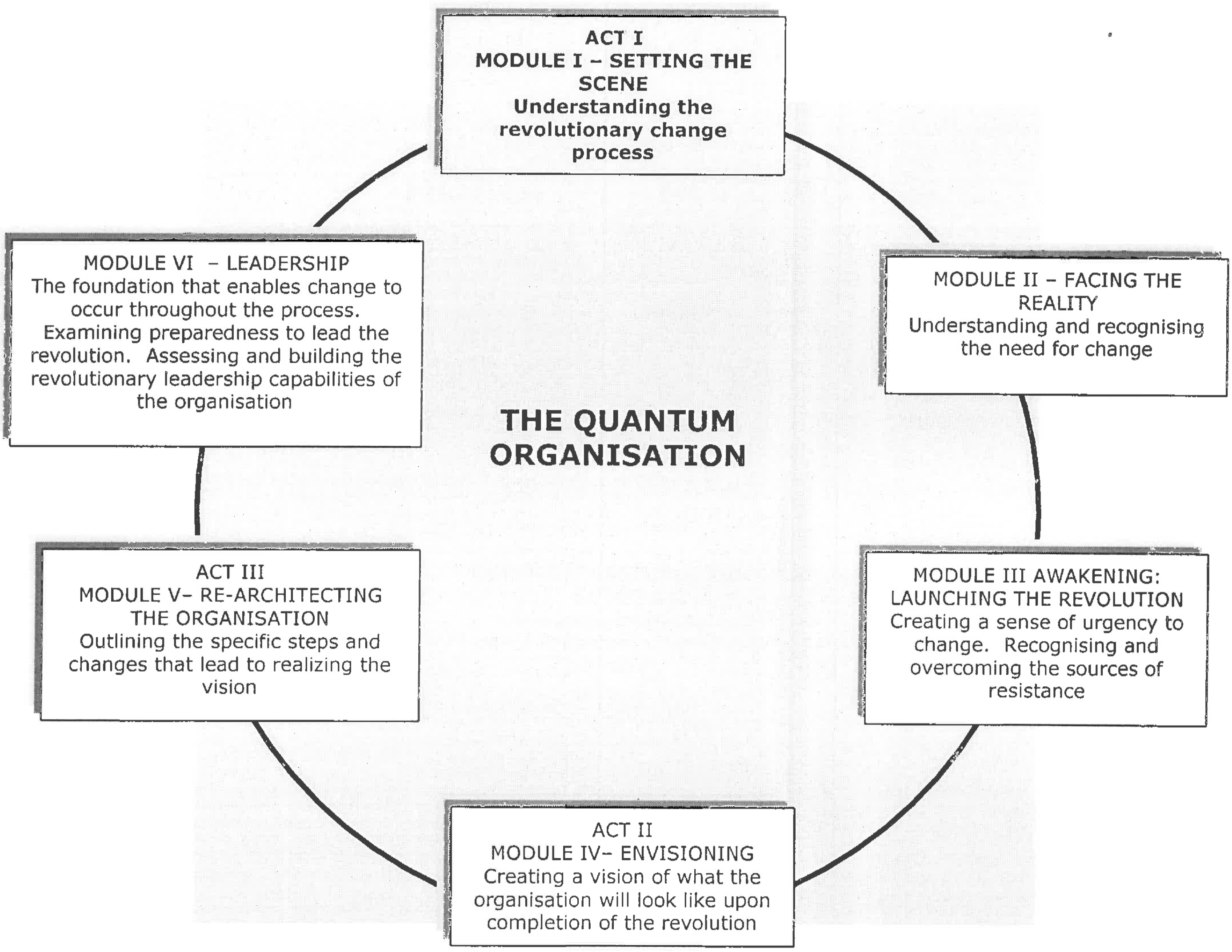
ACT I

RECOGNISING THE NEED FOR CHANGE

MODULE I - SETTING THE SCENE: MANAGING IN AN AGE OF TRANSITION

' But what are these highest studies?
The highest of all is the study of the Good whose possession is blindly coveted by all men, though none can give clear account of its nature.
Is it not obvious then that the Guardians of the state must study this Good? For, without it, how can they perform the duties of their station?'

Plato: xxiv



MODULE OBJECTIVES

In this, the first module, the scene is set.

The module focuses on the changing world and the reasons behind the changes. It studies Toffler's three economic waves and the eras of discontent that pave the way for a subsequent wave. It identifies the chaotic nature of the universe as collisions of waves.

The notion of critical mass is explored and the critical mass for Toffler's Information Age is identified as the introduction and rapid advancement of the microchip. It is also suggested that although Toffler's waves are different in that they served the differing needs of their times, inherently they followed a repetitive cycle – similar to Kondratieff's K-waves.

The module also serves as an introduction to the rest of the thesis, showing how Tichy's revolutionary change model could be employed to show the effect of technology and, more specifically, IT in serving as (and continuing to be) the major force in changing the business environment and the processes through which business is conducted.

Along with Toffler's waves and Tichy's change model, Plato's conceptions of the ideal state, form part of the rich vocabulary of learning that is created by the expansion of (information) technology.

1. A COLLISION OF WAVES

1.1 INTRODUCTION

It was in 1970 that Toffler conceived the rate of change of society to be exponential. He argued that there is an inherent reproductive principle in technology in that it is possible for technology to create more technology. He continued beyond that notion. He subsequently [1980] demonstrated that the economic world as we know it, has evolved through waves, each wave bringing with it its own specialisations, thus moving through the Agricultural Revolution, the Industrial Revolution and, subsequently, the Superindustrial Revolution – also known as the Third Wave. Each wave (of change) brought with it an era of discontinuity or dissatisfaction with the existing realities of the time. Thus, each wave itself constructed the force and gap for the next one.

Since Toffler's waves form the focal point of this thesis, they are summarised in the table below.

Table 2: Summary of Toffler's three* waves of economic discontent

	APPROXIMATE DURATION	DRIVING FORCE
FIRST WAVE	8000 BC – mid 18^{th} century	Physical labour
SECOND WAVE	18^{th} century – late 20^{th} century	Machines and blue collar workers
THIRD WAVE	1960s -	IT and knowledge workers

After: Toffler, 1980

Each wave is represented by an S-curve that shows an early period of dislocation, followed by a long spell of maturity and, subsequently, its eventual demise as new technologies replace the old. Societal structures and business structures become obsolete. The transition periods and the era of discontent that pave the

* *NOTE: Since the finalisation of this thesis, a fourth wave has emerged, namely that of BIO-TECHNOLOGY. It is submitted that the driver for this will be technology and that there will be a similar period of discontinuity (quantum age), because of the subsequent collision of the third and fourth waves – RP, November, 1999.*

way for the introduction of the new wave, constitute a period of chaos and turbulence during which there is an *unfreezing* from the current state, transformation and a *refreezing* into the new state when some equilibrium is reached. This introduces the notion of change and transformation. (These will be deemed the same for the purposes of this thesis). How long the period of equilibrium lasts, is uncertain. However, it is evident that the periods of discontent occur at shorter and shorter intervals of time.

These waves are schematically presented in Figure 2 below.

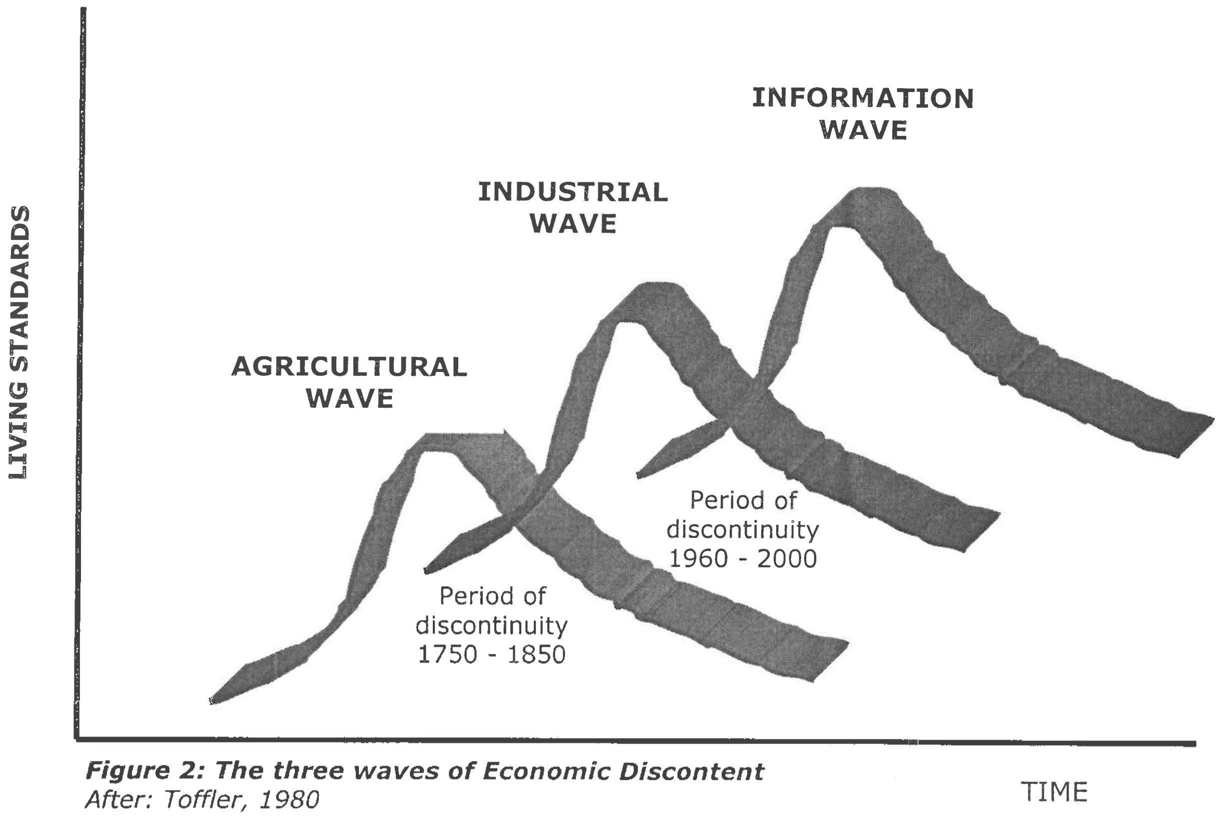


Figure 2: The three waves of Economic Discontent
After: Toffler, 1980

There is evidence that the world is reaching the end of the current (second) wave. Never before has the turbulency been as high as it is now. (Handy [1989] calls this, ' ..the age of unreason ..'.) If it is true that technology creates technology [Toffler, 1970], then, in all probability, the current wave cannot satisfactorily contain all the shifts in society – especially the shift in advancing technology and the resulting knowledge gained from this spur driving forcefully towards an unknown future. Toffler [1980] believes that humanity faces a quantum leap forward in terms of the deepest social upheaval and creative restructuring of all time.

Until now the human race has undergone two great waves of change, the first (wave) taking thousands of years to play itself out and the second (wave) a mere three hundred years. The history of the modern time is more expeditious and it is likely that the Third Wave will sweep across history and complete itself in a few decades. The imminent emergence of the Third Wave will affect all aspects of civilisation. It will challenge and contradict the old powers of relationships, the shared values and beliefs of our times and the fundamental nature in which the nations and businesses exist. It brings with it a new way of life based on diversified, new energy resources, production methods and information overload and flow.

The Third Wave economy is dominated by service organisations, with the line between manufacturing and services blurred and fuzzy. Service activities, such as design, marketing and customer support, provide significant value – even in manufacturing organisations. The knowledge (or intellect) of the workers is deemed the primary resource, thus introducing the emerging notion of knowledge workers. Organisations which want to survive and be successful in the age of discontinuity and the emergent Third Wave, will have to address real and different issues focusing on *how* this new resource will be accumulated and deployed on the shifting battle field. The old paradigm that services are intangible, ephemeral, not capital-intensive and generally play a minor role in economic activity, is something of the past [Hope and Hope, 1997].

The grand metaphor, according to Toffler [1980] is that of the *collision of waves,* resulting in social tensions, conflict and the break up of polarisations – which can be seen in the current build-up of tensions around the globe. This is also true for organisations around the world – the metaphor merely switches to the platform of knowledge – who owns it, how it is extracted, assimilated and implemented for quick decision-making in the complexities that confront leadership in organisations and nations alike. This author elected to refer to the current collision of waves and the infusion of the digital wave, as the Quantum Age.

The organisation of business as known today, originates from the Second Wave. Workers in SECOND WAVE ideologies generally bemoan the break-up of mass society, seeing this as fragmentation. Two hundred years after the Industrial Revolution dramatically changed the established world order, the world is again in a period of sharp transformation – the length of which is uncertain as is its outcome. There is no doubt that this gives rise to the same fears and uncertainties felt by eighteenth-century agricultural workers when they migrated from the fields to the factories. Job security has vanished with organisations re-engineering and downsizing [Hope and Hope, 1997] in an endeavour to remain competitive in an increasingly unstable environment. These methodologies brought with them their own sets of rules – and, arguably at least as many failures as successes.

The real engine that drives the Quantum Age is technology [Hope and Hope, 1997]. However, there are a number of factors that change the competitive landscape of organisations – even South African ones. These are:

- The evolution and impact of technology,
- the change in the global market (mainly through new technology),
- Government-driven changes (mainly deregulation and privatisation in the South African context),
- the changing face of the competition (to some extent through new technology),
- the changing pattern of employment (to some extent through technology) and
- The rise of knowledge as the key economic resource (mainly through technology).

1.2 A REPETITIVE CYCLE

1.2.1 KONDRATIEFF'S K-WAVE

Russian economist, Nikolai Kondratieff, mastermind behind the notion of the Kondratieff (K-) wave, was banished in the 1920s because his economic wave theory contradicted the Marxist dictum that capitalism will eventually devour itself. Capitalists did not like his idea either, since it implied that long periods of economic prosperity inevitably collapse. According to Kondratieff

> *'..that happened not just because people forgot the past, but because the past ceased to provide a valid guide to new realities brought on by change.'*
>
> *Kondratieff, 1920*

In the 1930s, Austrian-American economist, Joseph Schumpeter [Zwick, 1998] took Kondratieff's ideas further when he charted the K-waves from one period of calm to the next and found that waves of innovation and risk follow from periods of relative predictability when credit and venture capital are neither too free nor too tight and risk seems most quantifiable. Inevitably, some entrepreneur (dubbed '*the conductor*' by Schumpeter) introduces an innovation so radical that it disrupts the very stability that had made it possible. This conductor generally clears the path for other initiators to follow. Old rules no longer apply. People are forced to break with the past. Innovation begets innovation until the cycle (or wave) ends. Thus, the Industrial Revolution K-wave that reshaped the world in the first half of the previous century led to, but was separate from, the Neo-mercantilist K-wave that shaped (and was shaped by) the first half of this century. The first K-wave was launched by the works of Confucius and the art of printing almost one thousand years ago.

Schumpeter continues that, within these big waves (so-called K-waves), smaller waves exist. For example, the lean early 1970s followed the reckless 1960s and built a base for the Information Era following from the digital computer and the quantum-powered microchip. However, at the end of every big wave, even endless possibilities tend to be over-estimated and the wave starts to show signs of decline. Schumpeter believes every K-wave is a complete story in itself. K-waves are not about history repeating itself, but there are similarities from cycle to cycle. It is suggested here that in the transition to the new wave (Third Wave) it is possible to learn from the past, even though the new platform is that of knowledge.

1.2.2 HISTORICAL EPOCHS

Literature abounds with various studies examining the sources of disequilibrium, corroborating Toffler's theories. For instance, Imperato and Harari [1994a: 9] write

'Every beginning is in part an ending of something else.'

On transformation, they contend that

'Nearly all events that followed were influenced by a historic cataclysm. .. the impact of each transformation was universal: in manner, in time, in place.'

Imperato and Harari, 1994a: 10

In agreement with Toffler's contentions, they propose the following historical model for epochal changes, in which they maintain that dramatic changes have occurred only twice in the entire history of the Western civilisation. This model divides history into three periods, these being the Classical Age, the Middle Ages and the Modern Age. These are summarised in the epochal time line in Figure 3 below.

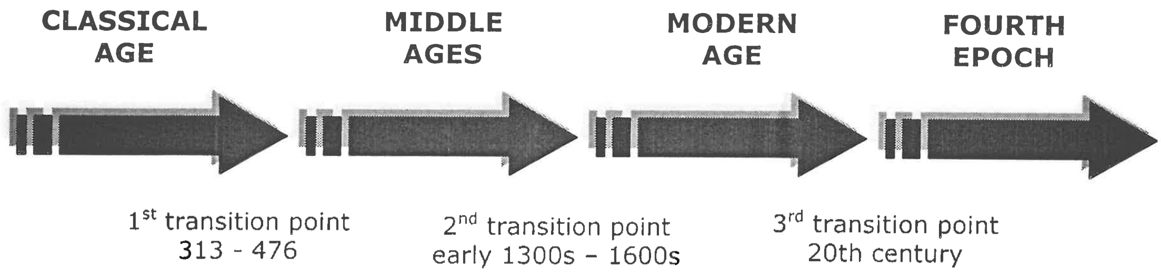


Figure 3: Epochal time line
Source: Imperato and Harari, 1994a: 11

These authors do not believe that any of these changes were sudden or abrupt - each dovetailed with a wide array of human activities - although they agree that the current transformation will occur more quickly than did the previous transitions with the pace of change continuing to accelerate. They see the revolution in communication and information technologies as the most dramatic driving force.

The most interesting aspect of their work lies in the following:

> *'Our ability to see similarities between what happened in the past*
> *and what is happening now strengthens our view*
> *that the modern era is deconstructing in front of us.'*
>
> *Imperaro and Harari, 1994a: 14*

They believe that one can identify a number of points of correspondence between the beginning of the modern era and current time. These are:

- Major revolutionary developments in communication and IT.
- On a grand scale, a pervading sense of vulnerability and, at the same time, a feeling of being on the threshold of tremendous opportunity.
- A far-reaching change in trade patterns.

- An environment of expanding horizons, spurred on by exploration and scientific discovery.
- A series of commercial revolutions that have yet to play out all their ramifications.

The tensions and crises of current times are part of a broader picture that reveals a world in the middle of another historic transformation. This perspective is not merely another warning about the new millennium. It holds that there are similarities between the beginnings of the earlier eras and the events that occur today. As Imperato and Harari [1994a: 15] put it:

'The past is the present unrolled for understanding;
the present is the future rolled for action.'

1.2.3 THE END OF A WAVE

From Kondratieff's and Schumpeter's beliefs, as well as Imperato and Harari's findings, there is evidence to support the theory that there is some pattern to the economic waves. Although one cannot predict *when* an existing wave will decline, the fact remains that it will decline. What the critical mass is to generate this change, is unclear. The microchip and its uses are mainly responsible for current trends in technology and applications of this technology may drive the next wave. This will be expanded upon in the next section.

A collision of technological, competitive and cultural pressures forms the vortex of the Information Wave. At the heart of the chaos brought about by markets and businesses trying to redefine themselves, organisational forms that no longer work and dated business thinking, the leadership has to make informed decisions. Futurists and management thinkers have invented terms to explain and navigate through these changes, namely 'paradigm shift', 'transformation', 're-invention', 're-engineering' and 'revitalisation'. The three major spurs to the quickening pace of change are [Champy and Nohria, 1996]:

- Technology,
- the changing role of government, and
- globalisation.

(i) *Technology*, particularly IT, is transforming business dramatically. Examples are virtual banking, digital commerce and digital publishing. IT is not only changing how work is done, it is redefining the business – this is specifically true for the Internet and digital commerce applications. It is altering organisational structures and enforcing dynamic new leadership models.

(ii) *Government,* in particular, is dramatically rethinking its role in business. On a worldwide basis, there is deregulation, privatisation and increasing free trade (for example, falling trade barriers allowing new players to enter markets and change the basis of competition). This leads to a rethinking by businesses as regards their purpose, their organisational structures and an enforced new leadership.

(iii) *Globalisation* is forcing organisations to re-organise themselves in radically different ways. Businesses across the globe compete to deliver the same product or service - the differential being speed, quality, deliverability and price (for example, giant multinationals like Asea Brown Boveri have become global as opposed to being tied to any particular nation state).

1.2.4 CONCLUSION

From the above, one may conclude that the economic waves or epochs – each serving the needs and purposes of the time - are by nature cyclical and repetitive. That is, although the exact *duration* of each wave is uncertain, principally, there is a shift in the paradigm (from agriculture, to industrial to information). Moreover, there is evidence of similarities between waves, the shift pertaining only to the needs of the time and how these needs are addressed.

Like the K-wave, there is evidence to support the believe that although the economic world has transcended two worlds and is in all likelihood entering the third where knowledge will rule, the paradigms within each wave are very much the same and only the platforms on which they are executed, differ.

During the course of this thesis, Kondratieff's K-WAVE or Toffler's Information (Digital) Economy or historical epochs will be studied, especially with regard to the transition (denoted by the term **Quantum Age)** after the above theories and those expressed by Hawking [1988].

2. CHANGING FACE OR FACING CHANGE

Change is too mild and misleading a term to account for the market chaos that businesses face today. Civilisation is being remade. What the world is experiencing in magnitude today, is similar to what happened some five hundred years ago, at the dawn of the Modern Age, when the printing press, the Scientific Revolution and overseas exploration began the democratisation and vigorous expansion of human knowledge. The current explosion in telecommunications, materials science and biotechnology, coupled with efforts at space and oceanic exploration, have combined to create a similar effect. The proliferation and integration of workstations, laptops, fax machines, cellular telephones and personal digital assistants have served to democratise information, spread power and dismantle traditional organisational forms based on hierarchy and functionalism. Old ways of thinking are being challenged at the same time as the current understanding of the world is enlarging. In businesses, the resultant destabilisation is discrediting some of the most cherished assumptions. Some of the cornerstones of business success are [Imperato and Harari, 1994b]:

- Standardised and undifferentiated products - instead of *radical segmentation* and one-to-one customisation.
- Quality is best managed as assurance at the end of the product – instead of being included in the design at the source by self-managed teams (often in collaboration with 'outsiders' like customers and suppliers).

2.1 CRITICAL MASS THEORY

The idea of *critical mass* is very important in this thesis. The notion of critical mass originated in physics, where it is defined as

> '.. *the minimum amount of radioactive material necessary to produce a nuclear reaction.'*
>
> *Masterton, Slowinski and Stanitsky, 1981: 582*

They explain that the critical mass of Uranium-235 required to maintain a chain reaction appears to be about 40 kg. Once critical mass is reached, the process becomes self-sustaining. The extent of the reaction and when it happens depend upon the concentration and purity of the radioactive material used and the geometry of the surrounding reaction system. Situations in which a process becomes self-sustaining after some threshold point has been reached, abound. For example: What was the critical mass for the adoption of Groupware to assist users compelled to do a common task in a shared environment?

Critical mass is like a landslide - a trend becomes a megatrend. It is the point when an accepted paradigm is replaced by another. Aburdene and Naisbitt [1993: xv] postulate that

> *'It is an idea whose time has come.'*

Once the critical mass has been achieved, the rate of adoption of an innovation becomes self-sustaining. Critical mass, although in itself a simple phenomenon, is intricate to execute. One can try to predict when the change will occur, but it is impossible to know exactly when until it occurs. The critical mass may be in place but needs some spark to set it off. However, critical mass is necessary, but not sufficient. The energy of critical mass must be manifested through the actions of the leadership and the choices they make for the businesses and societies that they serve.

2.2 THE MICROCHIP – THE CRITICAL MASS OF THE QUANTUM AGE

Microchips have long been used in calculators and digital watches. Microchips went into assembly lines, elevators, artificial pets, rocket ships and blenders. There seems no limit to their application. Their uses seem endless. There seems no danger of oversupply – and that supply creates demand. Virtually every technological advance over the last twenty years has occurred as a result of this innovation, including fractal and chaos simulations. The rapid application of the microchip gives credence to the notion that it will form the critical mass for the end of the current wave and the birth of a new one.

2.3 RADICAL CHANGE

Societal concerns (for instance, fear of nuclear events, the thinning of the ozone layer and quality of food and water) are exacerbated for businesses by added pressures like downsizing, restructuring and the chaotic nature of the capital markets. There is pressure from global competitors in a once secure domestic market. This is underscored by new commercial arrangements, with American capitalists interacting with Japanese and German models, where command economies more oriented toward free markets fuse to create one world economy consisting of multiple markets. The focus of trade has migrated from the Atlantic to the Pacific. Fluctuating inflation causes a questioning of values. The world is not at ease. There is a transition to another epoch. The world is leaving the existing era for a new stage in history. The primary lesson to be learnt from history is this: Periodically, like Toffler's economic waves, society needs a sharp break with old habits. It needs deliberately to learn new ways of existing and doing business. Leadership should see that simply 'pressing the pedal harder' by doing more of the same does not work, nor do cosmetic changes according to the ' flavour of the month' , nor do piecemeal solutions. Businesses needed *a radical redesign and total rethink* of the ways in which they did their business.

In 1990, Hammer and Champy changed forever the scene for companies who were trying to reinvent themselves because the environment and their customers said that they should, through the introduction of the concept of *re-engineering the business processes.*

'Any company that is more successful at restructuring than re-engineering will find itself getting smaller faster than it is getting better'.

Hamel and Prahalad, 1995: 12

The above summarises the (general) consensus and concerns with regard to the misconceptions of re-engineering and its confusion with downsizing and restructuring. Hammer himself, the father of re-engineering [Hammer and Champy, 1990] thought it necessary to plead for a *re-engineering* of re-engineering [Hammer, 1995]. Whereas, in 1990, the aforementioned authors outlined how companies should restructure in order to cut costs and position themselves for rapid growth and aggressive competition, in 1995 Hammer emphasises re-engineering for *growth* instead of cost cutting. He believes that many organisations misinterpreted the original message and used re-engineering as an excuse to slash employee numbers. He states that after an organisation has trimmed off the fat, it should re-engineer for growth. He believes that organisations that want to challenge their competition aggressively, should follow through on their re-engineering efforts to focus on products, customers and market share; that is, putting the business in a position to be more competitive and adaptable to change. This means an evolution of re-engineering as business evolves with it.

'A Company that cannot change the way it thinks about
IT, cannot re-engineer.
A company that equates technology with automation cannot re-engineer.'

Hammer and Champy, 1990: 83

Hammer and Champy's proposition of replacing a lacklustre diamond by a sparkling one suggests that IT forms an integral part of the new way of working. They believe '.. *state of the art IT* ..' to be '.. *an essential enabler* ..' in corporations re-inventing themselves and continue to cite examples of the misuse of IT in the organisation of work.

Some IT gurus believe that the main problem with re-engineering lies in the unflinching focus on the bottom line – not on the IT [Cowley, 1995]. They believe that redesigning processes as a cost-cutting measure is counterproductive as a lot of valuable knowledge and information tied up with these processes is simply discarded. Cowley subsequently decides that the shift towards re-engineering for growth is less an evolution of re-engineering than a mask for its failures.

Geisler [1997] contends that the BPR proposed by Hammer and Champy, cites IT as the enabling mechanism for organisations to reinvent themselves. The redesign of the work processes and the elimination of processes with little or no value added and the resultant overall redesign of the organisation depend on the existence and support provided by ubiquitous IT [after Geisler, 1997]. She believes that the fallacy in this contention is composed of the following dimensions that help explain the failure of BPR. These are:

- The information dimension and
- the *technology* dimension.

These will be elaborated on below.

(i) *The information dimension*

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

(ii) The technology dimension

- This is the pattern of evolution of IT from back room, cost-cutting efficiency purposes to front-end and strategic use for overall organisational performance, enabling organisations to advance on the learning curve.

Thus, it is possible that IT is not the catalyst and cannot act as such for BPR. It is suffering its own evolution. It certainly has brought about many changes in culture and the way work is performed, but it brings about its own form of change in the organisation – one that does not necessarily correlate with the intentions of BPR. In view of this, Hammer and Champy's contention stated above could be seriously flawed. The value of information will be discussed in Module IV and also in Module V, the latter with respect to its relevance to BPR.

There have been countless case studies of organisations showing dissatisfaction with their notion of re-engineering and the term *de-engineering*, seems to be replacing its predecessor. Thus even the proposed vehicles are themselves undergoing a change. The notion of *de-engineering* will be explored in a subsequent module (Module V).

It is suggested that the emergence of a new organisation and new organisational structures follows from the emerging new technologies at an ever-increasing pace. This brings with it a new turbulence, changing forever the classic management model and the ways in which business decisions are made. The business world is flooded with information and it is up to the new age leaders (managers simply will not exist) to deal with it intelligently and transform it into knowledge. Although the focus in this thesis is not on the aspect of organisational change dynamics itself, it will, however, make use of Tichy's well known revolutionary cycle above to develop new age systems of knowledge management, since the notion itself is revolutionary.

This thesis will focus on the Age of Transition (termed the Quantum Age) to reach Toffler's Third (or Fourth) Wave. It will question IT's ability to enable the company to transform itself as it should - the so-called IT black hole and, what this author terms, the '*keeping up with the Joneses effect'*. The notion of change will be researched – why it is necessary and how this may be achieved. The chaotic and turbulent environment in which the organisation has to exist and survive, will be studied as will *that* point in time where it is necessary to jump the curve (called the cusp or change point) be determined (mathematically and inferentially). Furthermore, so-called first curve companies and second curve companies will be studied to find out what makes them (the latter) different or better. In doing so, the focus will be on the technologies (mainly IT) available to make this possible. It will be shown that, in order to survive, the business should focus on Information Management. An attempt will be made to study the value chain of business data - from data to information, to knowledge, to prompting intelligent and timeous business decisions - thus, the creation of knowledge and ideas. This revolutionises business structures, policies and procedures.

This thesis will make use of Tichy's model denoted above according to the scheme presented below.

Table 3: Schematic presentation of flow of thesis

PROLOGUE		Introduction to the thesis
ACT I RECOGNISING THE NEED FOR CHANGE	Module I Setting the Scene	Managing in an Age of Transition
	Module II Facing the Reality	Inside Chaos
	Module III Awakening	The Emergence of the Chaordic Enterprise
ACT II CREATING A NEW VISION	Module IV Envisioning	The new Leverage of Knowledge
ACT III INSTITUTIONALISING CHANGE	Module V Re-architecting	The Case for De-engineering the Corporation
	Module VI Leadership	Twenty-first century Leadership
EPILOGUE	Conclusion	History repeats itself

3. QUANTUM MECHANICS AS ORGANISATIONAL THEORY

The term 'Quantum organisation' will be introduced in Module III after the notion in quantum physics developed by Planck. According to Hawking [1988: 55],

'..quantum mechanics does not predict a single definite result for an observation. Instead, it predicts a number of different possible outcomes and tells us exactly how likely each of these is. Thus, if one made the same measurement on a large number of similar systems, each of which started off in the same way, one would find that the result of the measurement would be A in a certain number of cases, B in a different number, and so on.'

Quantum mechanics thus introduces an unavoidable element of unpredictability or randomness into (any) science. Moreover, it has been the most outstandingly successful theory that underlies nearly all of modern science and technology.

Quantum theory was first proposed by Max Planck in 1900 to explain the properties of the radiation given off by hot bodies [Masterton, Slowinski and Stanitski, 1981]. Some years later, in 1905, it was used by Albert Einstein to treat the emission of electrons by metals exposed to light. Still later, in 1913, Niels Bohr used quantum theory to develop a model of the hydrogen atom. It is generally realised that the quantum theory is a general one that applies to all interaction of matter with energy. Its application to the field of business and change is fairly unfamiliar, but, for this author, relevant – moreso within the chaordic framework to be discussed in Modules II and III forming much of the focus of this thesis.

Greene [1999] contends that our understanding of the physical universe has deepened profoundly through the use of quantum mechanics and general relativity. Furthermore, Heisenberg's uncertainty principle[1] (also known as the

[1] *There are features of the universe that cannot be known with complete precision. Such uncertain aspects would become more severe as the distance and time scales become smaller [Greene, 199: 424]*

principle of quantum mechanics) which postulates that the universe is a frenetic place when examined on smaller and smaller distances and shorter and shorter time spans, thus denoting some interrelationship between uncertainty and frenzy.

It is contended that

- business organisations in some ways may exhibit similar behaviour patterns as the universe, and, secondly, that
- these uncertainties and frenzies in many ways reflect the uncertain futures and erratic behaviours exhibited by organisations when confronted with a changing environment and changing business rules and norms.

Thus, from quantum mechanics, may be borrowed some sense in the chaos of the Third Wave, and, use will be made of the term when describing organisations of the future in Module III (to be termed the 'chaordic enterprise', of which the quantum organisation will be a good example).

Greene [1999: 420] defines quantum mechanics as

'The framework of laws governing the universe whose unfamiliar features such as uncertainty, quantum fluctuations, and wave-particle duality become most apparent on the microscopic scales of atoms and sub-nuclear particles.'

This notion of uncertainty is underpinning all strategic objectives that leadership might decide to embark upon, since it infers a chaotic universe and environment wherein, the organisation has to orchestrate its own survival. This notion of chaos, and the subsequent order (= 'cha-ord'), is the focus of Module II and will be revisited in Module V with the notion of de-engineering to resolve the re-engineering failures.

4. THE IDEAL STATE

The quotations in the text have mostly been borrowed from Plato's dialogue, *The Republic.* This acknowledged masterpiece consisting of a large collection of essays have come down to us as the works of the Greek philosopher, Plato, making him one of the most familiar names in ancient history. Plato lived in a peculiarly significant historical period, and the events and people of that time are well known to the modern world.

During his lifetime (427 BC to 347 BC), there were continuous struggles and wars for the sake of nationalism and freedom. Living in such an age, he was witness to various political developments, one of these being the disgraceful trial and death of Socrates in 399 BC. There was the battle of Mantinea, the most important event in Grecian history, and the Sacred War that secured the supremacy of Philip of Macedon in Greece. Some of the richness of *The Republic*, is probably the result of his observations of the turbulent times in which he lived. At one stage in his career Plato was invited to enter Greek politics which he declined however, because of what he deemed enduring iniquities in the system – especially the condemnation of Socrates who had been his mentor. Like Socrates, he received no fees for his instructions and taught mainly through conversation, hence the dialogue form in his works.

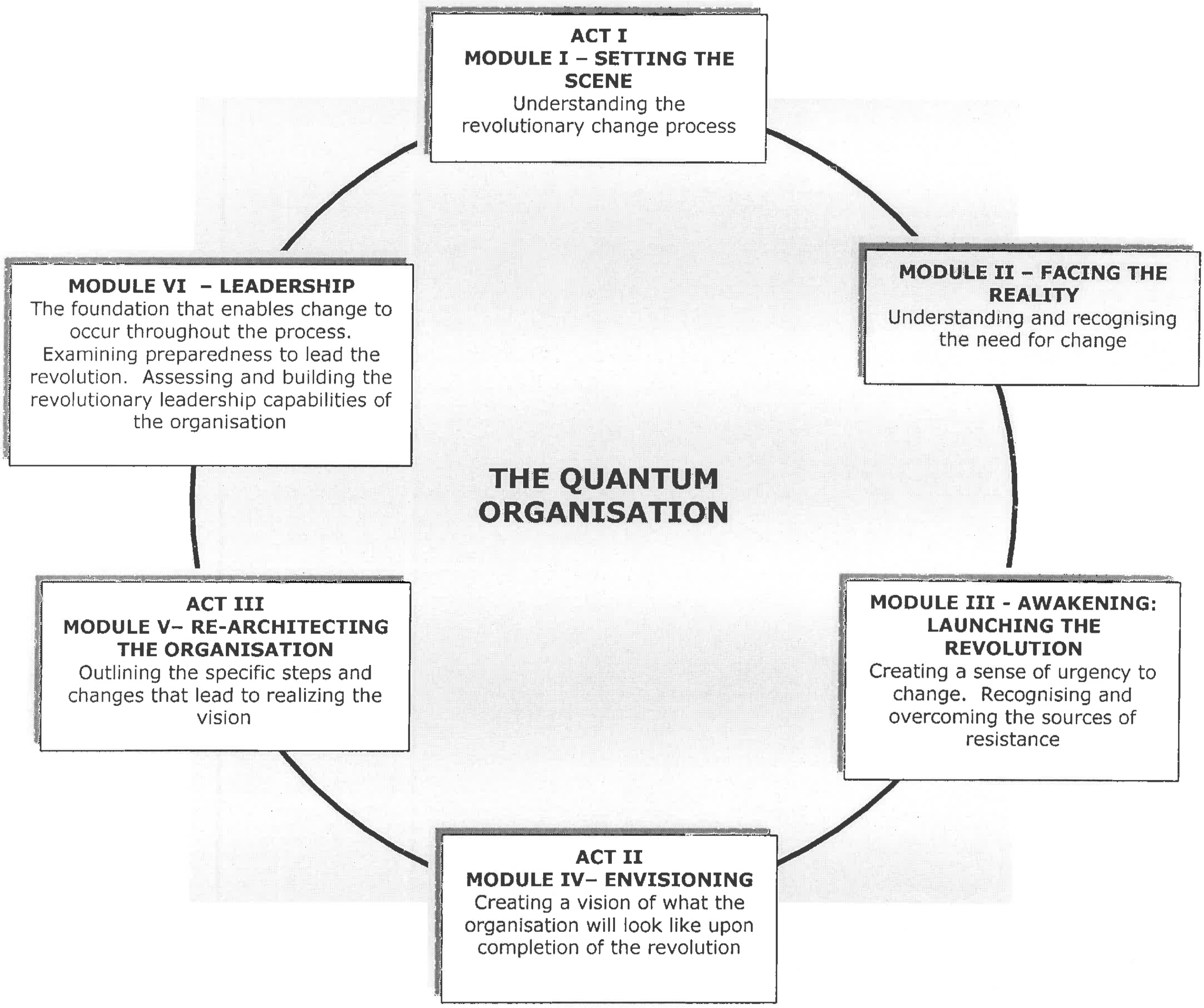
At one point in his life, he conceived the notion of applying his political science to the government of a state. He wanted to see the establishment of a state based on sound principles. Broadly speaking, Plato's *Republic*, spells out the nature of justice, derived from an inquiry, suggesting that justice would best be seen in the perfect state and that, when discovered, it might be recognised by an analogy to the individual. Accordingly the ideal state is constructed, and when this progress is completed, the inquirers discover justice. It is interesting to note that, Plato also made mention of two waves, these being *justice* and *equality*. Since to this author, the State is an extended form of personal mastery, the individual, the organisation and, on a broader scale, the state, all have to abide by the same set of rules and notions.

It is suggested that the jump to Toffler's Information Age, or what will be termed throughout this thesis, the Quantum Age (as the transition to the Third Wave – or the Fourth), in many ways relates to and can learn from the teachings of one of the great philosophers of the ancient times. Hence the many quotations supplied. May these have specific meaning in the twenty-first century.

MODULE II – FACING THE REALITY: INSIDE CHAOS

' If any state then may be described as master of itself, its pleasures and its desires, ours may be so characterised.'

Plato: 24



MODULE OBJECTIVES

This module explores the chaos that ensues from the collision of Toffler's waves. The notions of chaos and catastrophe are explored, following on the end of Newton's linear world. The notion of a 'chaord' (from chaos into order) is defined.

The net effect lies in jumping the (so-called S-) curve, wherein organisations are warned that nothing less than radical change will suffice and that there is a breaking down of old rules and ways of thinking. Technology is identified as one of the driving forces behind the jump.

The notion of the cusp (change point or bifurcation point) identifying the moment in time for the jump, will be explored.

1. INTRODUCTION

The world has dissolved into a series of events designed to orchestrate *chaos and confusion*. Most of what has been assumed in the past no longer fits the current reality. Society has passed a great divide into a subsequent era, leaving behind the needs, commitments and alignments of the past hundred years or so [Peters, 1987]. After the turbulence of the creative destruction that accompanied the Industrial Revolution, a new set of mechanisms was put in place. What followed was a great wave of innovation, entrepreneurial bio-engineering, information revolution and an internationalisation of the economy, culminating in the creation of the *knowledge society*.

The consequence is the advent of a *culture of risk*, in that business outcomes are only predictable in the shortterm. The future is in disorder with structures constantly changing and decaying [Van de Vliet, 1994]. She warns that the unpredictability arises because of the system's extreme sensitivity to initial conditions - tiny variations amplify into huge consequences. For example, it is now possible that a single innovative gadget could have the power of making entire markets obsolete. In this lies the leader's greatest challenge: To force obsolescence of a product by the introduction of a new product, rather than letting a competitor do so [Lawler and Galbraith, 1994].

Ross [1994: 159] calls this a notion of break-up, since a '..*non-standard world is thrown at a standardised system*'. In this new culture of risk, business will have to undergo more radical restructuring than at any time in the past.

Change, and *managing* that change, is the challenge that every organisation faces. It is the latter that means the difference between winning or losing in the ultra-competitive new world order. Ross [1994], forecasts that global businesses are headed for a once-in-200-years' revolutionary change not to be fully realised until the year 2000. He predicts that those who recognise this new world order of global business and learn to exploit the change, will capitalise on the resultant opportunities created. These forces include technological acceleration far more advanced than anything ever seen since the Industrial Revolution, a massive trend towards *customisation* and movement away from the centralised hierarchy (which he calls the '*molecular organisation*') in which companies will organise themselves around entire markets. He warns that change really happens by things 'bubbling' along seemingly undetected for a long time until something finally gives way, resulting in discontinuous change.

The question of whether there is any warning of this discontinuity could be partially answered in the affirmative. Change may be examined from a historical point of view. Such an example could be found in the fall of the Berlin Wall, typifying massive social change. Although the fall of the Wall could be said to have happened overnight, its fall in real terms, was the result of the slow demise of communism after many years of evolution. Consequently, change cannot be seen as a constant, but rather as discontinuous [Drucker, 1994].

Every system, be it political, social or industrial, contains the seed of its own destruction. Mass production has given birth to an economic demon called *mass customisation*, that is effectively reducing the market to one size [Peters, 1987]. The consequence of this is that the product has not been standardised, only the *market* has. The marketing game has put on a new face. Customisation of products has caused shorter cycle times, thereby removing inventory and the distribution channels used for mass production. Since the 1980s, the number of consumer products has increased exponentially.

Today's companies are still rooted in the old order. Old structures have been broken down, but no alternatives put in their place. The modern manager needs to take stock of where we are in this new age industrial system, since even big companies will flounder [Lawler and Galbraith, 1994]. Companies that can exploit this new order will reign supreme over their competitors. Theirs is the choice whether they will treat change as a measure of survival or as a great new opportunity to move a customer ahead. This is re-invention time. It calls for another Naisbitt and another Taylor to create order where there is chaos. Moreover, there is no guarantee that the process will be painless or that it will be quick. Even the outcome is uncertain.

2. NEWTON'S LINEAR WORLD

Recent years have seen a tremendous surge of interest in the sciences and their bearing on the rapidly changing outlook of the universe. Mathematicians have played a substantial part in the evolution of scientific and philosophical thought comparable to that of the philosophers and scientists themselves. The emphasis is on those great and simple guiding ideas of mathematical thought that are still of vital importance in living, creative science and mathematics. The basic ideas of modern mathematics, from which the whole vast and intricate complexities of the current business environment have been woven by thousands of workers, are simple, of boundless scope, and well within the intellectual grasp of today's leadership.

It must not be imagined that the sole function of mathematics is to serve the sciences; it has a light and wisdom of its own. This will be explored here to the extent that it (mathematics) becomes viable for the turbulence of the new millennium.

'I do not know what I appear to the world, but to myself
I seem to have been only like a boy playing on the seashore, and diverting myself in now and then finding a smoother pebble or a prettier shell than ordinary, whilst the great ocean of truth lay undiscovered before me.'

Such was Isaac Newton's estimate of himself towards the close of his life. For completeness, and since they have bearing on this thesis, Newton's three laws of motion are stated [Bell, 1953]:

1. Every body will continue in its state of rest or of uniform (unaccelerated) motion in a straight line except in so far as it is compelled to change that state by impressed force.
2. The rate of change is proportional to the impressed force and takes place in the line in which the force acts.
3. Action and reaction are equal and opposite.

Of particular importance, is the opening statement of the second law of motion, namely *rate of change*. What is this rate and how is it measured? The masses Newton investigated remained constant during their motion. This adds a measure of predictability to his philosophies. The third law, in a business context, warns of the effect of change and that the result of the change (be it radical or otherwise) is as great as the change itself in magnitude.

Newtonian science, the underpinning of civilisation from the 1700s to the present, is rooted in physics and mathematics – rule-bound disciplines that require data up front in order to operate. The core of the paradigm, namely the laws of motion above, suggests that the world is a well-behaved machine. It offers the promise of a well-behaving and predictable universe. It underscores the belief that relationships between cause and effect are simple, clear and linear.

This ' ..if X, then Y follows ..' view of the world prevailed for two centuries, delighting the scientists whose primary objectives were to predict and control. With the advent of the Industrial Era, Newtonian science led us to focus on businesses from a stable system perspective. Whenever some force would upset the system, it would be the leadership's duty to re-establish equilibrium. Not to do so would constitute failure. With stability as the ultimate goal, the paradigm implied that order should be imposed from the top (the top down, command-and-control leadership style) together with supporting structures for decision-makers (resulting in bureaucracies and hierarchies). These were the cornerstones of the Scientific Management movement, having as its building blocks regularity, predictability and efficiency.

3. CHAOS - THE EMERGING PARADIGM

3.1 CHAOS AS A SCIENCE

Chaos, as referred to in the sciences, *is a revolution in the understanding of the way the world works*. Its revelations have overturned Newton's law-abiding universe and replaced it with a world of infinite complexity and in which everything is connected in a vast, ever-evolving web. Chaos in a business sense *does not infer collapse of the organisation and its structures, rather it refers to the eminently orderly disorder* that mystics for centuries (and scientists fairly recently) have recognised as nature's way [Bonnie, 1997].

Traditionally, mathematicians and physicists, not to mention mystics, had little to say to each other. They each operated within the sacrosanct walls of their own intellectual ivory towers, awaiting contrary opinions from each other. However, in the 1960s, meteorologists, mathematicians, physicians and biologists observed through their respective experiments, that nature's behaviour seemed unpredictable, forming random and complex patterns described by equations that would not resolve into straight lines but that bifurcated at odd points and behaved according to their own preconceived notions – almost like clouds in the sky. This brought about the discovery that nature, contrary to their belief, is indeed erratic in its behaviour. This was contrary to the Cartesian belief in nature being a spiritless matter whose whole could be grasped by analysis of her parts or that of Newton who thought nature to be like a well-behaved machine set in motion by God and driven by laws the world could probably control if these were understood. Thus nature was not the rational and eminently orderly extrapolation of the human mind.

3.2 CHAOS AS A THEORY

The very term *chaos theory* is misleading. According to [Murphy, 1996], some researchers prefer terms like 'non-linear dynamics', 'bifurcation theory', 'change theory' or 'self-organising theory'. Although it incorporates elements of chance, chaos, she believes, is not random disorder. Rather, it attempts to understand the behaviour of systems that do not follow a linear pattern or show conventional cause and effect over time. When viewed as a whole, these systems exhibit definite patterns and structures. However, at no single point can their future behaviour be predicted from the past. In this sense, chaos is far from random and therefore chaotic systems can be both determinate and unpredictable. These systems can organise and renew themselves, with periods of order broken by sudden transformations in a direction that has elements of chance and cannot be reversed.

A brief review of the foundations of chaos theory is given below [Murphy, 1996]. These are:

- Non-linearity,
- feedback,
- bifurcations,
- strange attractors,
- scale,
- fractals and correspondence and
- self-organisation and self-renewal.

(i) *Non-linearity*: Central to so-called Newtonian science is the principle that causes and effects have a proportional relationship, in that small changes in original conditions can induce consistent changes in their effects. On the other hand, chaos theory proclaims that (even minuscule) changes in some systems' initial conditions could amplify exponentially in their effects which could have little resemblance to the beginning. This makes anything beyond short-term predictions impossible.

(ii) *Feedback*: Newtonian science poses a machine-like universe that regulates itself according to pre-set laws. Thus systems maintain their stability through feedback and corrective actions to preserve the steady state. Newtonian science assumes that stability is the norm and that instability is an error to be rectified. On the other hand, chaotic systems evolve from accumulated feedback acting like an iterative process. Output at every step in the system provides material for a new formulation and new outcome, thereby amplifying deviation and working to destabilise existing states and introduce new patterns.

(iii) *Bifurcations and phase changes*: Destabilising the system can lead to new directions, character or structures – called bifurcations. This is the point where, because of the catastrophic leap, the system arranges itself around a new (different) underlying order. (The term 'catastrophic' as used here refers to sudden discontinuous behavioural shifts in the response system and not to disasters such as earthquakes or floods. Refer to Section 4.3.) Although the occurrence of bifurcations can be predicted, their outcomes cannot.

(iv) Strange attractors: It is important to note that the unpredictability of a system does not denote a lack of coherence or structure. This possession of structure is termed 'attractor', meaning that it is an organising principle, an inherent state of affairs to which a phenomenon will always tend to return no matter how random single moments seem. Chaotic systems have strange attractors whereby outcomes wander constantly and unpredictably within a bounded range. Maps of such situations in which multiple variables are pulling events in contradictory directions, resemble the scribbled doughnut or butterfly wings familiar to mathematicians. Still, the underlying order represented by the attractor limits excessively erratic behaviour and imposes structure, even though unpredictability may exist within the bounds of that structure.

(v) Scale: Since the evolution of a chaotic system is vastly complex and also prone to disturbance by chance, it is impossible to determine its underlying pattern by looking at a single event. Interpretation of the form and coherence of a chaotic phenomenon is affected by the scale used to measure and view it. Thus knowledge of the full map (or history) is important since different behavioural patterns can prevail in different parts of the map. This is different from the Newtonian logic which advocates generalisation from the part to the whole. Chaos theory maintains that one should see the whole (not the parts) to make decisions.

(vi)Fractals and correspondences: Following on the previous notion, chaos theory assumes that concentrating on individual units yields different or misleading information. This holistic view in chaos theory differs sharply from the Scientific one that believes that the behaviour of microcosms can be used to deduce that of the whole system. Thus the qualitative measurement of a

fractal was introduced by Mandelbrot to describe the relative degree of complexity of an object. This enables the decision-maker to identify correspondences or couplings between forms that vary significantly in scale but exhibit similar patterns of complexity. In a chaotic system, a *strange attractor* is a fractal curve that imbues all the diverse elements it governs with its own underlying pattern. Thus a fractal representation of a system shows very similar, though not identical patterns at successively greater magnification. This makes it possible to analyse chaotic systems by tracking similar patterns through successive stages of evolution.

(vii) Self-organisation and self-renewal: The ability to reorganise is inherent in the chaotic system itself and does not require any external intervention. Some theorists believe that this sensitivity of a chaotic system to its own history enables it to pull out of disarray – as well as impelling it into chaos. Thus, chaos follows an inner logic on the one hand and has continuity on the other, because of its iterative nature. Thus, a chaotic system is an unstable combination of randomness and plan, broken by flashes of change.

Chaos science therefore highlights the role of chance, the possibility of many outcomes and the ability of the observer to choose which outcome will be called reality. It is emancipatory, with the price for open-endedness being extreme uncertainty and the loss of a sense of control. In a business sense, chaos theory could explain diversity theories (for instance, feminism or racism). It offers not so much novel solutions as a structure for persistent problems and new models, since it emphasises uncertainty, open-endedness, plurality and change. In this it runs counter to the goal-oriented, certainty-seeking mode of Toffler's Second Wave.

3.3 THE END OF NEWTON'S LINEAR WORLD

The (now dated) Newtonian philosophy of a mechanically predictable and stable universe married the Scientific Revolution to the Industrial Revolution. Newtonian structures require a vast hierarchy exerting increasing control and requiring more and more resources to keep the system in operation. This post-modern viewpoint sees time as reversible, meaning that one could move backwards and forwards at any point and the same essential laws would be in operation. Hock [1997] calls this the 'age of management' or more to the point, the management of constants (as opposed to the Quantum Age introduced in Module I and the Quantum Organisation in Module II). In this paradigm, the business world digressed into management of constants, uniformity and efficiency while the needs were in terms of co-ordinating variability, complexity and effectiveness – these in themselves constituting the essence of change. It also implies that the word 'organisation' is an impasse, increasingly archaic and irrelevant, and also antithetical to the unstable spirit and unpredictable nature of the world.

The modern world does not allow for *float*, that is, natural intervention between an invention and its assimilation into society [Hock, 1997]. In the continual blur innovation and change chase each other, leaving no time for float. Thus, change is not going to happen, nor is it likely to happen. Change is the very nature of what is happening.

3.4 CHAOS THEORY AS THE NEXT ORGANISATIONAL PARADIGM

The question is whether chaos theory can provide businesses today with the necessary methods and metaphors to deal with the shifting paradigm of work. Does its self-organising capabilities lend themselves to the self-organisation of people in companies? Is there utility in chaos and complexity theory which could add to (even supplant) Newton's laws?

Chaos theory has been successfully applied to operational problems [Tetenbaum, 1998]. He cites examples of companies that have used complexity-based computer systems to develop programmes for manufacturing. These models solved operational problems better than linear techniques, thus saving time and money.

Self-directed teams represent a small version of *self-organisation*. The dominant organisational culture and shared values can be deemed a *strange attractor* and business cycles behave according to the *phase changes* and *scale* that engender systems thinking.

While chaos theory offers few practical guidelines, Murphy [1996] sees three caveats about intervention within a highly unstable environment. These are:

- Change has to evolve from within, it cannot be imposed from the outside.
- Intervention works most efficiently at critical points, when the system is well on the road to instability (the 'burning platform effect').
- There should be quick response and actions at these crisis points, otherwise the system may take on its own shape – which might not necessarily be congenial to the organisation.

According to the chaos paradigm, the organisation should not attempt to control existing attractors but should rather fit into them. On the other hand, accepting the metaphors of the chaos paradigm in no way negates completely the models of Newtonian science. Either approach can be appropriate, depending on whether the system behaves predictably or not. At this stage, however, chaos theory is more useful as an analogy than a source of practical solutions for relationships between organisations and their environments. It helps in structuring persistent problem situations where there is insufficient knowledge about cause and effect relations and where leadership is able to act in unpredictable ways. In this sense, chaos theory provides rules as definite as the Newtonian ones it challenges. The new rules (pluralism, change and chance) may bring some comfort to leadership. However, in many situations, chaos theory balances out the overly rational management styles and approaches in situations where pro-activity cannot prevail.

It provides a useful antidote to overly rigorous linear views without being a fully satisfactory replacement.

3.5 INTRODUCTION OF A CHAORD

Having said that there are indeed systems the behaviour of which is non-linear, it seems paradoxical to mention that these same systems have order, that is, that there is order in chaos and chaos in order [Bonnie, 1997]. According to Hock [1997] there is an organisational and situational model in existence, termed *chaordic*, that does *not* follow the traditional (linear) organisational pattern, but through which order emerges and structure evolves. In practical terms this means that, unlike the linear idea of cause and effect (which can be visualised as a set of falling dominoes) in a chaordic system, one small change can accomplish substantial and unpredictable changes throughout the system. Hence, through the chaos, some pattern emerges and the system reaches some new form of equilibrium (or order). At this new point, there will be a recognisable pattern, coherence and cohesion within infinite diversity. The most prominent example is nature's ability to create (and never repeat) a single human being.

Definition of a chaord

Organisations, because they are made of people and hence are highly complex, are non-linear systems. Chaos in this sense is described as complex, unpredictable and orderly disorder in which patterns of behaviour unfold in irregular but similar forms. This is called 'bounded equilibrium' or 'chaordic' by Hock [1997], referring to the combination of chaos plus order. He believes that in chaordic systems, order emerges, structure evolves and life is a recognisable pattern within infinite diversity.

In this sense, chaos is referred to as ' *..the science of chaord or of chaordic systems ..'* [Fitzgerald and Van Eijenatten, 1998], combining cha-os and ord-er. Chaordic systems are entities in which nothing ever happens quite the same way twice, but enough happens in a neat enough way to preclude complete disorder. Thus, every system in the universe is by definition a chaord.

Definition of a chaordic enterprise

Although every organisation is also by definition a chaord, the term *chaordic enterprise* will refer to those rarefied enterprises in which for the most part, the most of the two most fundamental properties of reality mentioned in the above context are maintained in dynamic balance by virtue of an intentional management process. (See Module VI.)

In Newtonian systems, a hierarchy is preserved at the cost of flexibility. The question is whether it is possible to compare societal structures to the empirical principles of science. About this, most modern-day management theorists are in accord. Not only should the business world take cognisance of the erratic complexities of the Quantum Age, it should use these as a map for change. The rationale is that, like the chaos models, human nature is by definition immensely complex and highly susceptible to fluctuations. (Witness the many cultures of diverse nature evolving through the short span of history.) Examples of chaotic events abound throughout history, especially in connection with the innovation of new technologies. For example, the invention of the stirrup in the 11th century revolutionised battles. Another example is the introduction of the personal computer which has revolutionised modern-day communications. These all bear testimony to the notion that one small innovation (or change) can alter a nation or revolutionise the way society operates. On a broader scale, the chaotic nature of the environment affirms the reality that the (secure, stable, permanent) universe has disappeared forever.

4. JUMPING THE CURVE

Organisations must face and conquer the chaos that exists in the new world order. Today's explosion into telecommunications, science and technology, into global markets, challenges the old ways of thinking. In this changing environment, the corporate leader can no longer assume that his business can run along the old rails of the past. History teaches that, periodically, society as a whole needs to make a *sharp break* with old habits. This is also the destiny of business. Business needs to move from chaos, tumult and confusion into clarity - into a new business order. There appears to be neither any half measure nor a piecemeal solution. The answer lies in *integrated solutions* [Imperato and Harari, 1994].

Charles Handy's [Handy, 1995b, Craig and Grant, 1993] so-called sigmoid (or S-) curve in Figure 4, describes the organisation's natural life cycle. Any new idea, product, business or industry starts at the bottom of the curve, struggles through early development, increases its expansion, grows and succeeds over time - as represented by the steep gradient of the curve (growth phase). Success gradually slows as market conditions change and new competitors and technologies emerge - as represented by the levelling-off of the curve (maturity phase). This is followed by the downward slope of the curve (decline phase). Handy goes on to state that the sigmoid curve sums up the story of life itself:

'We start slowly, experimentally and falteringly,
we wax and then we wane.'

He mentions the stories of the British Empire and of the Russian Empire and continues to warn that the units of time are decreasing and that the accelerating pace of change is shrinking every sigmoid curve. The curve is given in Figure 4 below.

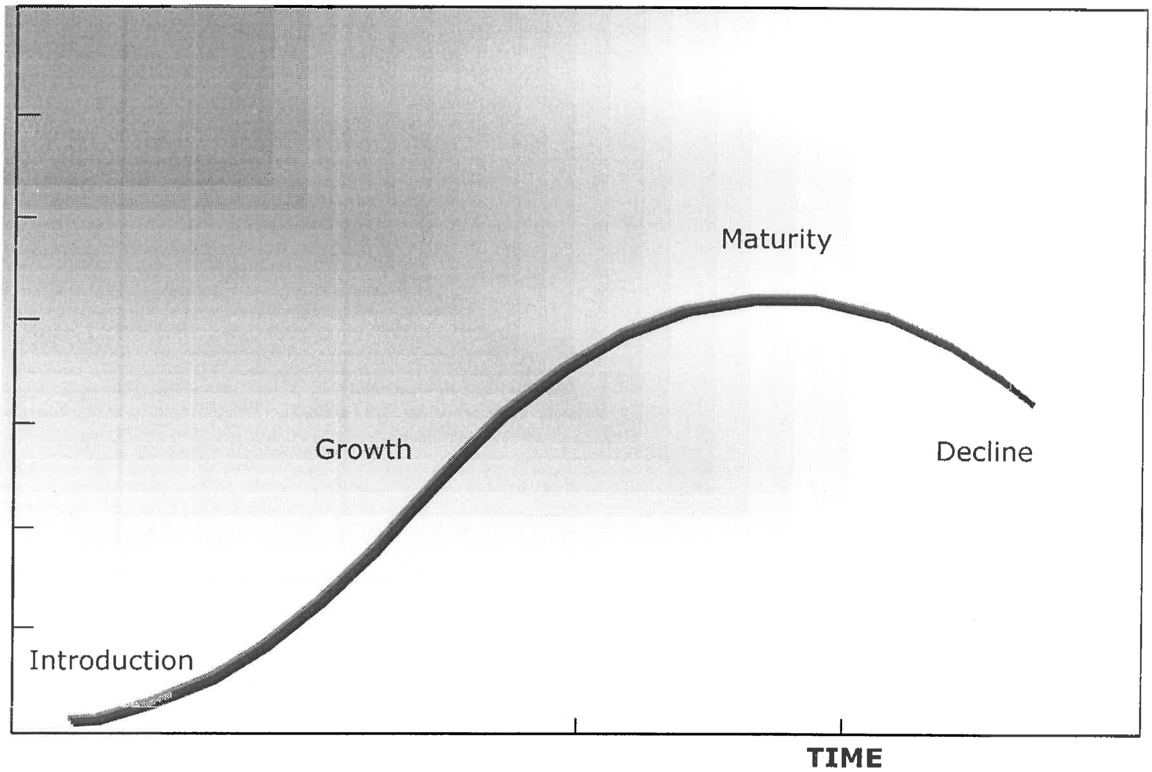


Figure 4: Handy's S-curve showing the natural business cycle
Adapted from Craig and Grant, 1993

The situation clearly needs a new boost and organisations need to consider carefully, to anticipate when it is time to jump that curve [Imperato and Harari, 1994]. It demands of leadership the invention of a new curve for their business, discontinuous from the previous one, in order to rise to new, higher levels of success. Every new curve is discontinuous of the others since it is based on a different set of assumptions and business opportunities as shown in Figure 5. To keep prospering, companies should consider a new strategy at point A, (moving instead to C and not to B) while business is doing well.

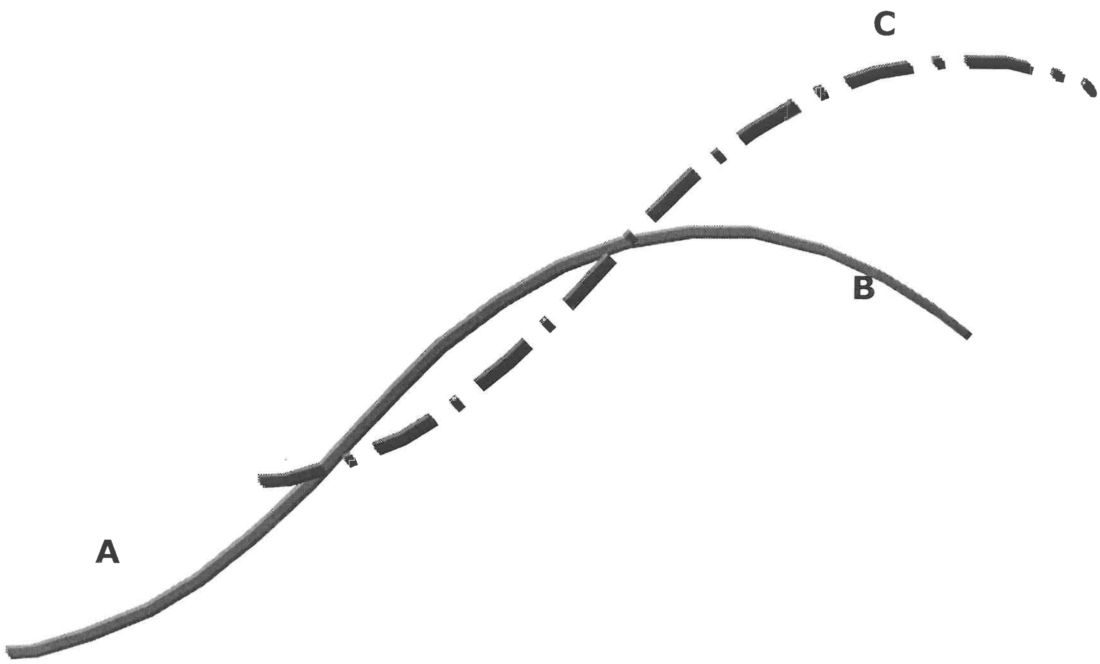


Figure 5: Jumping the curve
Source: Handy, 1995c: 51

In practice, this means conforming to a new set of values, theories and practices. It obviously involves a change in corporate culture. It means doing things *differently.* It means changing one's way of thinking, from doing things right (efficiency) to doing the right thing (effectiveness). It means switching from internal thinking to external thinking. This leap into the unknown can be intimidating and people are afraid of the unknown. Even if they realise that they have to leave the present curve, they are uneasy about the realities of the new curve. More than that, generally that curve has to be *invented.*

In the following section, the time to change, that point in time denoted by the term the 'cusp' or point of transition, will be explored.

4.1 TIME TO CHANGE - IDENTIFICATION OF THE CUSP

4.1.1 DEFINITION OF THE CUSP

No organisation can escape the need to re-skill its people, redesign its processes, reshape its product portfolio or redirect its resources. Hamel and Prahalad [1994] believe that organisational transformation is an imperative for every organisation. According to them there are different platforms for the transformation, these being *pro-active*, *pre-active* or *reactive* (these will be explored in Module V in more detail, the focus here is to identify the point in time to act, known as the cusp). They [Hamel and Prahalad] write in this regard:

> *'The real issue is whether transformation happens belatedly – in a crisis atmosphere – or with foresight – in a calm and considered atmosphere; whether the transformation agenda is set by more prescient competitors or derives from one's own point of view about the future; whether the transformation is spasmodic and brutal or continuous and peaceful. There is often a high price to be paid for brutal and belated transformation.'*

They conclude [1994: 21]

> *'The goal is a transformation process that is revolutionary in result, but evolutionary in execution.'*

This section addresses the issue of *when* it is time for radical change. In this, it distinguishes between the *pro-active* (radically changing at time T_1), *pre-active* (radically changing at time T_2) and *reactive* (radically changing at time T_3) transformations identified by the above authors.

Formally, the cusp can be defined as that point at which two curves meet [Oxford Dictionary, 1993]. It is also called the 'transition point', denoting the passing or change from one place, state or condition to another. Mathematically, the cusp is at the point of inflection of a given curve (a point of singularity), while from a statistical viewpoint the cusp is called a 'change point'.

4.1.2 MATHEMATICAL DETERMINATION OF THE CUSP

Handy's S-curve is often used to describe the life cycle of a product, an idea or organisation. There is a need for radical change in the growth (pro-active), pre-actively in the maturity phase or reactively on the downward slope of the curve. The curve may be described by a number of models, one of which, the Gompertz function, which will be discussed below as an example.

(i) *The Gompertz curve:*

The Gompertz curve is generally used to summarise Handy's S-curve. Farnum and Stanton [1989: 189] explain

'Some phenomena (e.g. demand for newly developed products) exhibit rapid growth early in their history followed by a declining growth rate until they reach an upper saturation level accompanied by practically no growth. A trend curve with an S-shape may be useful in these cases.'

Following from their modified exponential curve, the model below is proposed

$$S' = \log S = \beta_0 - \beta_1\beta_2^{T} + \varepsilon \text{ [2]},$$

[after Farnum and Stanton, 1993: 189].

[2] *For the modified exponential curve, β_0 = the trend value at time zero, β_1 = the amount by which the trend value is multiplied to calculate the trend value in the next period ($0<\beta_1<1$), β_2 = determines how fast the rate of growth declines (i.e. the closer β_2 is to 0, the slower the curve will grow toward its upper saturation level) and ε = the relative movement of the series away from the trend at time t (error term).*

This curve may be redefined in terms of the following general business model:

$$\log S = K - MN^T,$$

where, in accordance with the β-values above, the following are true:

$T \equiv$ time elapsed,

$S \equiv$ demand for business output, and

K, M and N $\equiv$ constants such that:

K is known as the upper saturation level, $0 < M < 1$ and N determines how fast the rate of growth declines.

Then three change points (or cusps, T_1, T_2 and T_3) are relevant following from the pro-active, pre-active or reactive scenarios discussed earlier. These cusps can be summarised in terms of the first and second derivatives (Table 4).

In Mathematics, the point of inflection is that point on the curve where the function changes from concave to convex, that is, where $\frac{\delta^2 S}{\delta T^2}$ changes sign. Ideally, the change should be orchestrated at the point of inflection during the growth phase, indicating a *pro-active* decision to change (*that is, designing the future and making it happen*). It is also possible to be *pre-active* in the decision to change (*that is, maintaining a strategic fit in terms of our expectation of a possible future*), in which case the jump should be orchestrated during the maturity phase at the saddle point. It is also possible (yet not advisable) to be reactive in the decision to change (*that is, from a crisis management perspective)*, in which case the jump will be orchestrated after the maturity phase has been reached on the downward slope of the curve. The latter phenomenon is known as the burning platform scenario.

Table 4: Summary of alternatives for jumping the curve

SCENARIO	**CHANGE POINT (CUSP)**	**DERIVATIVES[4]** **FIRST DERIVATIVE**	**SECOND DERIVATIVE**
Pro-active (during the growth phase)	T_1 (inflection point)	$\frac{\delta S}{\delta T} > 0$ $\frac{\delta S}{\delta T} > 0$	$\frac{\delta^2 S}{\delta T^2} > 0$ $\frac{\delta^2 S}{\delta T^2} < 0$
Pre-active (during the maturity phase)	T_2 (saddle point)	$\frac{\delta S}{\delta T} > 0$ $\frac{\delta S}{\delta T} = 0$ $\frac{\delta S}{\delta T} < 0$	$\frac{\delta^2 S}{\delta T^2} < 0$ $\frac{\delta^2 S}{\delta T^2} < 0$ $\frac{\delta^2 S}{\delta T^2} < 0$
Reactive (during the decline phase)	T_3 (not an inflection point if it is accepted that the curve will asymptotically reach 0)	$\frac{\delta S}{\delta T} < 0$ $\frac{\delta S}{\delta T} < 0$	$\frac{\delta^2 S}{\delta T^2} < 0$ $\frac{\delta^2 S}{\delta T^2} < 0$

Note: The terms pro-active, pre-active and reactive will be explained in context in Module V (Figure 29).

PRO-ACTIVE SCENARIO:

It follows that the (pro-active) point in time (say T_1) can be obtained by solving T from the equation $\frac{\delta^2 S}{\delta T^2} = 0$. Solving T_1 from the equation, $\frac{\delta^2 S}{\delta T^2} = 0$, one obtains $T_1 = \log_N(\frac{K - M}{N})$, with K > M (0<M<1) and N positive. Thus, in order to

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3 *For the Gompertz curve cited above,* $\frac{\delta S}{\delta T}$ = -MN^T logN (K-MN^T)exp(K-MN^T) and

$$\frac{\delta^2 S}{\delta T^2} = \text{-MlogN[logN.N}^T\text{(K - MN}^T\text{) - N}^T\text{(MlogN.N}^T\text{)]}.$$

be pro-active in the radical change, the time to change should be around the point in time calculated by T_1 in terms of given values for K, M and N.

PRE-ACTIVE SCENARIO:

It follows that the (pre-active) point in time (say T_2) can be obtained by solving T from the equation $\frac{\delta S}{\delta T} = MN^T \log N\,(K + MN^T) = 0$. Thus, it follows that $MN^T \log N = 0$, thus $T_2 = -\infty$ (that is, no solution) or $K - MN^T = 0$, thus

$T_2 = \frac{\log \frac{K}{M}}{\log N} = \log_N \frac{K}{M}$, with K > M (0<M<1) and M positive. Thus, in order to be pre-active in the radical change, the time to change should be around the point in time calculated by T_2 in terms of given values for K, M and N.

REACTIVE SCENARIO:

Since there is no inflection point because of the assumption that the function asymptotically tends to infinity, no unique solution exists under this scenario. This suggests that it is not possible to be reactive in decision-making if the Gompertz curve is assumed relevant.

CONCLUSIONS:

Ideally, one would expect the jump to occur around the T_i value (i = 1, 2) obtained under the pro-active or pre-active scenarios. Any movement after the saddle point has been reached ($\frac{\delta S}{\delta T} = 0$) is reactive in nature, the optimum solution being around the point of inflection. The jump cannot be orchestrated under a reactive scenario since there does not exist a solution. The following general family of functions is proposed by this author as they follow Handy's suggested shape, but provide cleaner solutions under the scenarios discussed above.

(ii) *Proposed model for the pro-active, pre-active or reactive scenarios:*

The following family of functions provide greater scope in terms of applicability and form for Handy's S-curve.

Let

$$f(t) = -b(ct-a)\exp(ct-a)^{4},\ 0 \le t \le \frac{a}{c};\ \text{a, b and c are positive constants.}$$

where a, b and c are positive constants with respect to the specific business or industry and t is the expected time to jump the curve.

As before, three cusps are relevant pertaining to the different scenarios. These lead to different signs of the first and second derivative, as in Table 4 above. Letting $\frac{d^2f}{dt^2} = 0$, one finds $T_1 = \frac{a}{c}$ resulting in a negative second derivative. From this one may conclude that the pro-active cusp point in time occurs *after* the inflection point. Letting $\frac{df}{dt} = 0$, one finds $T_2 = \frac{a+1}{c}$ resulting in a negative first derivative. From this it follows that the pre-active cusp point in time occurs *after* the saddle point (where $\frac{df}{dt}$ is negative). As before, no unique solution exists under the reactive scenario because of the assumption of an asymptotic distribution.

In conclusion, the main problem with the above methodology, is that the specific functional relationship should be known *a priori*, with T the only independent variable. The above method would serve organisations that optimally have large enough data sets (generally, time series data) available to know *a priori* the behaviour (distribution) of the variable(s) they are studying (for example, sales

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4 $\frac{df}{dt} = -bc\exp(ct-a)[1-ct+a]$ *and* $\frac{d^2f}{dt^2} = -bc^2\exp(ct-a)(a-ct)$

data) and need to make predictions in terms of new product development and the obsolescence of existing products (the second proposition serves a wider variety of distributions than the first). Whether these values are in fact readily and abundantly available, is questionable – one reason being that time series analysis requires typically large data sets (rare in fast changing industries) to be accurate in their predictions. The Gompertz curve, since it follows Handy's S-curve could be used if not enough data is available to determine a model specific to the organisation's own history or industry. Alternatively, models of the form proposed under (ii) could be fitted using statistical modelling techniques.

4.1.3 INFERENTIAL DETERMINATION OF THE CUSP

In Statistics, the term 'change point model' is generally taken to mean those models in which a change in parameters or functional form occurs at some point in a sequence of observations [Dictionary of Statistical terms, 1990].

A description of the simplest type of change point problem is given by Lombard [1989]. Consider a time ordered sequence of independent observations x_1, x_2, .. , x_n with distribution functions F_1, F_2, .. , F_n. If $F_1 = F_2 = .. = F_n$, the data are homogeneous, that is x_1, x_2, .. , x_n constitute a random sample from a fixed distribution. More generally, suppose that, for some integer τ ($1 \leq \tau < n$), x_1, x_2, .. , x_n have a common cumulative distribution function F, while $x_{\tau+1}$, $x_{\tau+2}$, .. , $x_{\tau+n}$ have cumulative distribution function G. Then a change of distribution has occurred with τ called the change point or cusp.

The following serve as principles of hypothesis testing[5] for the above change point models.

[5] *For more information regarding statistical inference and regression techniques, refer Levine, Berenson and Stephan [1998].*

(i) *General hypotheses:*

For the above-mentioned case, the following are valid as general hypotheses to be tested:

Test $H_0 : F = G$ (hence $F_1 = F_2 = \, .. = F_n$), against
$H_a : F \neq G$,

and subsequently, estimate τ in the event of rejection of H_0.

If τ is known, this becomes a two sample problem for which various parametric and non-parametric tests exist. The distinguishing factor in change point analysis, is that τ is not known *a priori*.

(ii) *General construction of test statistics:*

Construction of tests for H_0 can be based on the well-known two-sample tests. Consider Z_τ an appropriate test statistic for the two sample problem involving $x_1, x_2, .., x_\tau$ and $x_{\tau+1}, .., x_n$. Then obvious choices of test statistics for testing H_0 against an alternative involving an unknown change point are

$$\max_{1 \le r < n} Z_r \ \text{ or } \ \frac{1}{n} \sum_{1 \le r < n} Z_r \, .$$

The main focus in statistical literature involves the derivation of exact or approximate distributions of such test statistics. Examples of these are discussed below.

(iii) *Parametric tests:*

Parametric tests involve tests where the underlying distribution (normal, exponential, or otherwise) may be assumed to be known.

Let x_1, x_2, .. , x_n be independent and normally distributed with respective means μ_1, μ_2 , .. , μ_n and common variance σ^2. The simplest model for change in mean after the r^{th} observation $(1 \le r < n)$ is given by

H_0: $\mu_i = \mu^*$, against
H_a: $\mu_i = \mu\, I(1 \le i < \tau) + \mu^*\, I(\tau+1 \le i < n)$ for some unspecified value τ and indicator function I.

The subsequent test statistic is

$U_n = \max\, (|T\tau| : 1 \le \tau < n)$,

which follows the t distribution with n-2 degrees of freedom. Also, $T\tau$ corresponds to the familiar test statistic used for a two sample test (independent observations) of the means, the latter respectively being $\overline{x_\tau}$ and $\overline{x^*_\tau}$ for the two groups and pooled variance σ^2. The major problem is that the two groups need not necessarily be independent.

Tests also exist for the exponential distribution, the binomial distribution and the Poisson distribution.

(iv) *Situations that may complicate these derivations:*

The above methodology assumes some underlying distribution – the knowledge of which, *a priori*, is generally not available [Lombard, 1989]. Moreover, the number of change points are assumed to be at most one (known as AMOC). (The latter may be corrected using procedures based on ranks.) Another problem is establishing the presence of nuisance parameters, that is, testing for a change in the variance of a normal distribution with fixed but unknown mean. One should also determine whether some value can be classified as a significant change point or a statistical outlier. (Simple rank tests may solve this problem.) Lastly, the x_i are not independent, but are generated by some auto-regressive scheme – thus negating the assumption of independence in the t test above.

(v) *Rank tests:*

Suppose that x_1, x_2, .. , x_n are independent with unspecified density functions, given by f_1^{θ}, f_2^{θ}, .. , f_n^{θ}. and let r_i denote the rank of x_i, $1 \leq i < n$. The distribution of the rank vector r_i does not depend upon the underlying density, provided that the θs are all the same. The simplest way of constructing a non-parametric test is to replace x_i in the parametric procedure by $\varphi\{\frac{r_i}{(n+1)}\}$, where φ is an appropriate score function defined and integrable on the interval (0;1), depending upon the type of parameter involved (location or scale).

Examples are:

For location parameters: $\varphi(u) = 2u-1$ (Wilcoxon score),

$\varphi(u) = \Phi^{-1}(u)$ (normal score) and

for scale parameters: $\varphi(u) = (2u-1)$ (Mood score),

$\varphi(u) = -\log u$ (Savage score).

(vi) *Estimation of the change point:*

In the event that the null hypothesis of no change point is rejected, one has to determine the change point. An obvious estimate of τ is the point $\overleftrightarrow{\tau}$ at which the absolute standardised cusum $\frac{|C_k|}{\sqrt{k(n-k)/n}}$ attains its maximum, where $C_k = \sum_{i=1}^{n}\left(x_i - \overline{x_n}\right)$, $1 \leq k < n$. This estimator $\overleftrightarrow{\tau}$, is not sufficient for the parameter [Hinkley, 1970] τ since the distribution of the sample $x_1, x_2, .., x_n \mid \overleftrightarrow{\tau}$ is not independent of τ. Moreover, it is not possible to obtain a consistent estimator for τ, because increasing the sample size has no effect on the shape of the likelihood function. Thus, especially in the non-parametric case, no satisfactory estimation of the change point is yet available.

(vii) Regression analysis:

Suppose that $x_1, x_2, .., x_n$ have the linear model structure

$x_i = A_i\beta_i + e_i$, where
A_i = 1xp row vector of known constants,
β_i = px1 column vector of unknown regression constants and
e_i = independent and identically distributed random variables.

Then the simplest regression change point model tests
H_0: $\beta = \beta^*$, against
H_a: $\beta_i = \beta$ for $i \leq \tau$, and $\beta_i = \beta^*$ for $i > \tau$.

Much research has been done in this field, although few researchers offer exact or asymptotic tests. One aspect that has received attention, is the situation where $x_1, x_2, .. , x_\tau$ and $x_{\tau+1}, .. , x_n$ form parts of two time series with spectral densities f_1 and f_2 respectively. Software has been developed by Venter and Steele [1995] locally, called 'Abrupt Change Point Analysis' (ACPA), written in Visual Basic, that determines, for a given data set, the possible change points – not necessarily AMOC. The programme assumes independence of observations.

In most business applications, data are time-ordered, that is, x_{i+1} is observed after x_i and constitute a time series. Nevertheless, the full data set, $x_1, x_2, .. , x_T$ is available for analysis and the situation differs from that encountered in sequential data analysis. In the latter case, the data are analysed with the advent of every new observation, the objective being to detect a change as soon as possible at the outset. The sample size is generally not determined by a data-dependent stopping rule and the analysis is retrospective by nature. Lastly, the methodology depends to a large extent on known probability distributions – generally not easily determined empirically.

The above methods require *a priori* determination from the organisation to determine the closest fit with one of the above functions (or some other function) that summarises their past behaviours.

This author does not entirely agree with Macmillan [1989] who recommends that it is still possible for organisations to jump the curve during the decline phase. This may well be what many (if not most) organisations do, but being neither pro-active neither pre-active, will be a sub-optimal solution at best, as opposed to strategy.

4.2 BUSINESS APPLICATION OF THE CUSP

In astrology, being *on the cusp*, refers to being born near the change of astrological signs. This makes astrological interpretations uncertain. *'On the cusp'* in a business sense, refers to the age of discontent between the production orientation of the past and the Information Age ahead. Thus, the cusp could also refer to the movement towards the Quantum Age or into a different epoch. On a smaller scale, organisations need to determine when they are on the cusp of their current business and to be able to jump onto a new curve to bring them competitive advantage.

4.3 CATASTROPHE THEORY

4.3.1 DEFINITION

The mathematics of smooth, continuous change cannot explain abrupt or sudden changes. Models which result from the use of such mathematics, tend to imply that sudden change is not permissible, or at least, not reasonable. However, sudden changes do occur. Catastrophe theory is concerned with the phenomenon of rapid or sudden change. The French mathematician, René Thom, proposed and developed these theories to explain the behaviour of systems. In 1972, he postulated that there are elementary catastrophes represented by mathematical equations that described generalisations of systems that move rapidly from one state to another. Catastrophe theory helps to model discontinuous, abrupt changes in a variable (behaviour) as a result of small, continuous changes on one or more other (control) variables. According to Karathanos, Pettypool and Troutt [1994], it allows for models in which abrupt change is not only permissible but expected. Instead of experiencing the surprise of unexpected movement or behaviour, one may expect catastrophe theory to help explain (and possibly prepare for) the sudden changes in the behaviour variable. Moreover, Wright [1983] believes the theory useful in handling situations in which qualitative data are prevalent and in which qualitative management decisions have to be made. The theory may also assist in the determination of appropriate data for quantitative decision-making.

According to Stewart [1975] catastrophe theory applies to systems with a high degree of friction which are governed by an energy function (E). The equilibrium states respond to stationary values of E.

4.3.2 CUSP CATASTROPHE MODELS

The advantages of using cusp catastrophe models (response surfaces) are twofold. These are [Gresov, Haveman and Oliva, 1993]:

- Their ability to capture, in a single response surface, both incremental and sudden shifts in strategic response, and
- the fact that there are means to estimate such models containing multivariate constructs that are necessary for dealing with complex strategy variables.

In this, the name may be misleading since it implies only catastrophic situations (earthquakes, tornadoes or floods), whilst, in reality, the term refers to sudden discontinuous behavioural shifts in the response system. Catastrophes may be described as points whose fundamental processes move towards states of minimum or maximum potential (for example, a clock pendulum stopping). Such models are only appropriate for so-called state-descriptive systems. In these systems, the current state depends upon the prior state, and, statistically, would show high levels of autocorrelation in a regression analysis. In catastrophe theory, the state variable exhibits the rapid change and the change is caused by control variables. Thus there is some correlation between the 'state' and the 'conditions' to which the system is subject. Where this is not the case, catastrophe theory is inappropriate.

Scapens, Ryan and Fletcher [1981] define the *cusp catastrophe theory* as

' .. concerned with the analytical explanation of sudden changes in the behaviour of a system, arising as a result of smooth changes in the factors which determine the attainable equilibrium states of that system.'

The state in which one finds something, is a function of the conditions in which it is embedded. For example, water is frozen below zero degrees Celsius at atmospheric pressures, whilst water boils if the temperature reaches one hundred degrees. Hence, for a given temperature, a physicist is able to determine the state in which water, in its liquid form, would be found. At a social level, Governments try to take steps and create conditions under which the population will continue to vote for them, or organisations try to create *conditions* (wages, benefits and others) that will avoid the *state* of labour unrest. Indeed, a significant proportion of the quality philosophy, is based on the premise that, under the right conditions (for instance, empowerment of employees), the right state will be achieved (for instance, quality products). Organisations try varying techniques to alter the conditions, for example: cross-functional teams, delayering, training and management by objectives.

However, not all systems follow the natural law that there is a direct correlation between the state of the system and the current operating conditions. According to catastrophe theory, in some situations, under apparently identical conditions two states are possible.

There is some sort of jump from the one state to the other. This jump is typical of catastrophic systems and may occur without being noticed if no mechanism is in place to detect this. This results in the possibility of overcompensation.

Typically, in organisations, there may be a drive towards decentralisation or re-engineering with every unit and element in the system driving towards the goal. The result may be fragmentation, with unco-ordinated efforts negating the drive towards success. Hence, long before the optimum position of balance has been attained, the conditions are already in place and the system goes too far the other way. The figure below schematically summarises this situation and presents the classic view of catastrophic systems as well as the cusp.

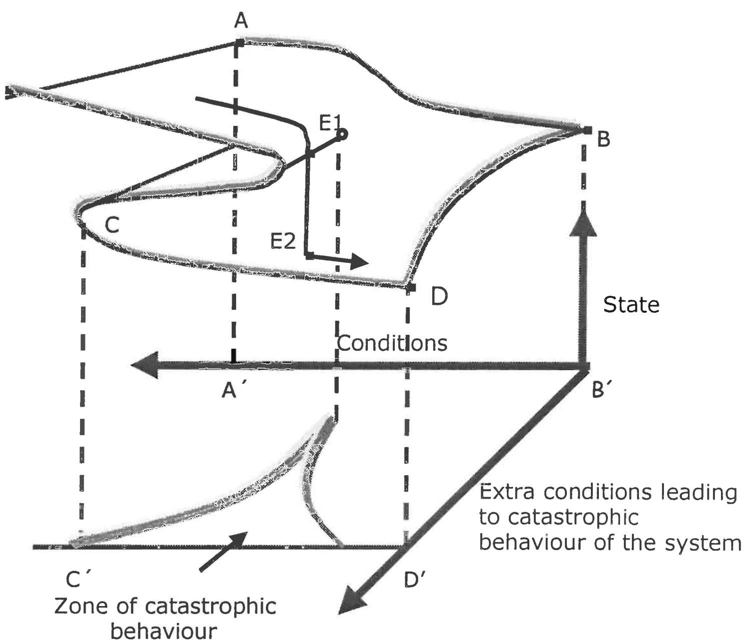


Figure 6: Schematic representation of catastrophic systems
Source: Finlow-Bates [1993: 471]

Along the line AB, a positive correlation exists between the 'state' (for example, operating efficiency) and the 'conditions' (for example, length of communication lines, span of control). In a catastrophic system, along the line CD, two equilibrium points are present (namely, E_1 and E_2) for virtually the same set of conditions. In endeavouring to direct the system by varying one of the conditions along what management believes to be an appropriate path, the system jumps undetected into a totally new position on the curve with a totally new state (denoted by A'B' and C'D').

4.3.3 MATHEMATICAL IDENTIFICATION OF THE CUSP

Gresov, Haveman and Oliva [1993] cite the following generic form of the cusp function

$$f(z) = \tfrac{1}{4} z^4 - x\,y - \tfrac{1}{2}\,y\,z^2.$$

This is depicted in Figure 7.

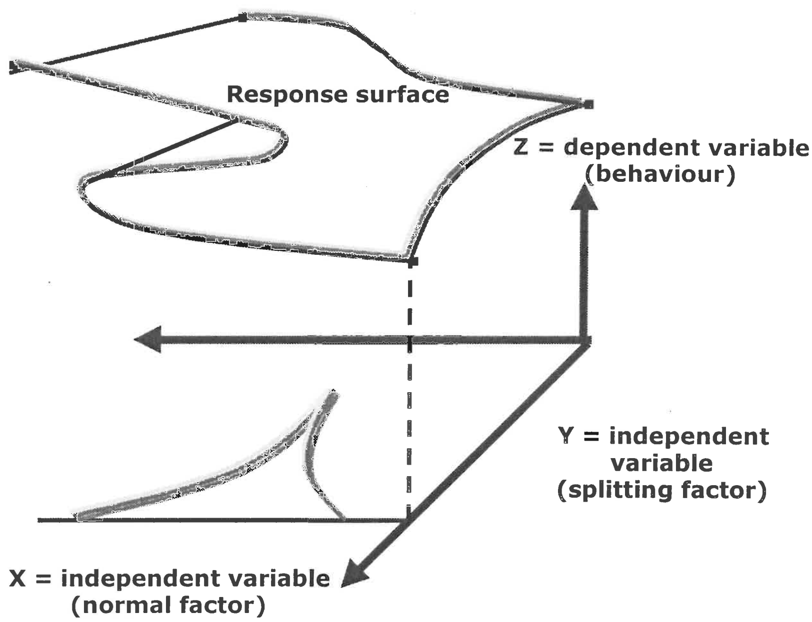


Figure 7: Generic form of the cusp function

Thus, mathematically, the cusp model is given by the set of maxima (or minima) points

$$\frac{\partial f}{\partial z} = z^3 - y\,z = 0.$$

The following holds for the above variables:
X, Y = independent variables,
Z = dependent variable,
X, Y and Z are assumed to be latent constructs that can be estimated,
X = 'normal factor' because Z changes directly with X,
Y = 'splitting factor' because the response surface bifurcates as the value of the variable is increased beyond some point known as the singularity.
Thom's seven elementary catastrophes (of which the above is one) are summarised by Oliva, Day and Jedidi [1987].

Movement occurs on the surface of the model in Figure 7. Changes in the independent variables cause changes in the dependent variable. If Y is small, smooth changes occur in Z (directly proportional to changes in X). At high values of Y, large changes in X will result in relatively small changes in Z, until a point is reached where there is a sudden discontinuous shift in the z value.

The state or response variable is given by the vertical axis and the folded surface shows the response achieved for differing combinations of control variables. Jumps (up or down) occur only at the edges of a fold, and therefore it is possible to trace out paths on the response surface that do not lead to a simple jump.

Taken in totality, movement on the surface (that is system response behaviour) has five distinctive qualities that are characterised as [Aislabie, 1992; Gresov, Haveman and Oliva, 1993]:

- Sudden shifts,
- bimodality,
- hysteresis (or lag effects),
- divergence and
- inaccessibility.

These are explained below.

(i) *Sudden shifts:* These occur when the system crosses the pleat boundary and falls or breaks down. When measured on the dependent z axis, this appears as a sudden discontinuous change in behaviour.

(ii) *Bimodality:* According to this notion, the fold occurs where the path is on the top sheet or the bottom depending on its direction of approach. It refers to the area bounded by the cusp. Beyond some critical value of Y, the surface bifurcates, forming the pleat. Within this region, the dependent variable can take on two possible values for a given (x; y). A small reduction in the value of the X variable does not cause an immediate return to the bottom surface.

(iii) *Hysteresis:* This notion comes about where a fall would occur at a different point from an upward leap. There is a lag and the reduction in the value of x must be significant.

(iv) *Divergence:* Two paths may start from slightly different initial conditions, but lead to quite different values of the state variable, since one path ends up on the top sheet but the other on the bottom sheet. Small differences in starting conditions can result in totally different system behaviours.

(v) *Inaccessibility:* Given the nature of movement (that is movement up or down at the cusp boundary) the middle sheet is inaccessible. This represents the least likely area in terms of potential or behaviour.

Additional knowledge of the system is gained from the slope of the tangent to the surface at any point. A change in the magnitude of the slope indicates the approach of discontinuity. As before, the second (partial) derivative provides information on the behaviour of the system:

$$\frac{\partial^2 f}{dz^2} = 3z^2 - y$$

from which the *moment of inertia* (cusp or change point) may be derived as

$3z^2 - y = 0$, namely $z = \sqrt{\frac{y}{3}}$.

Note that this approach differs from that presented by Gresov, Haveman and Oliva [1993:188] but this researcher is satisfied that the above is mathematically solid and fits the structure presented in previous sections of this module.

Each point in the above diagram (Figure 7) represents some combination of control variables and each path shows how particular combinations of these variables may change. Above each point is one or more points on the response surface (depending on where the base is in relation to the fold in the surface). The jump occurs on one of the boundaries of what is termed the 'bifurcation set' – the jump actually occurs when a boundary, representing the edge of the fold in the response surface, is reached by one of the variables, which is called the 'splitting factor'. These boundaries meet at the *cusp* (derived from the above). While a jump will occur on one of the two boundaries of the 'bifurcation set' (whether it is the first or second boundary met by the 'splitting factor') depends on whether or not the boundary is immediately below the fold in the response surface above. In tracing out possible paths, it should be noted that the shaded area in Figure 9 is inaccessible and points on the edge are semi-stable, while those on the underside represent unstable maxima.

An application of the cusp catastrophic model is presented by Scapens, Ryan and Fletcher [1981]. They provide an example in which credit extension is a function of return on funds and the organisation's operating risk. The apparently continuous relationship between credit extension and return on funds will change once the organisation's operating risk is taken into account. The net effect of the addition of the variable (operating risk) in the model is that, while a small variation in return by a successful organisation may not change the credit worthiness class to which the organisation is assigned, a change in return that exceeds some limit will cause a substantial jump in the relationship between credit extension and return on funds (also operating risk). This may be represented by a catastrophic manifold which embodies one state variable and two control variables, the normal factor and the splitting factor which are responsible for the jump conditions in the model. Although there is a jump in the state variable, both the other variables are smooth. The jump in the state variable has not resulted from an assumption of the existence of a jump in either of the control variables. The model is appropriate because the causes of the jump are endogenous, whereas normal plotting of the state variable against each of the control variables results in a fruitless search for dummy variables or any other exogenous variable in order to explain the irregular pattern in the data.

Following from Figure 7, the exposition below firstly considers the various outcomes from the process (found on the surface) and, subsequently, the changes in the control variables that caused these outcomes (at the base). The control variables are represented by the base of the diagram.

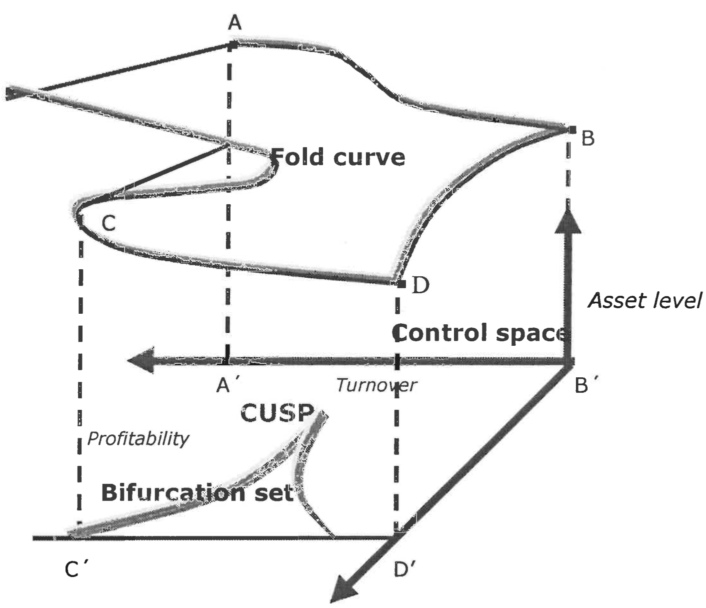


Figure 8: The catastrophe cusp model for growth
After: Aislabie, 1992

Although not all paths make mathematical sense, their precise contexts give them economic content. The growth of any small business can be used as an example (also refer to Handy's S-curve in Figure 4). Any small business starts with self employment, which in turn, provides the production function of the new economic unit (including the human capital and interaction with customers). Mainly, the business will grow through the abilities of the founder, increasing turnover. This in turn, increases the need for human and physical capital (the latter depends in turn on the availability of financial capital). The result is increased reliance on financial resources external to the business. As a consequence, there is a change in the amount of assets under the control of the business. Since, generally, profitability is measured in terms of assets, the business will seek to contain and lower its costs. Thus, in order to jump from 'asset-poor' to 'asset-rich', it will seek to create a perception of creditworthiness – even through disinvestment.

It is also possible to determine this version of the cusp through a multivariate modelling technique known as GEMCAT [Oliva, Desarbo, Day and Jedidi, 1987]. The procedure is computer-based and is described in full in the above article.

While it is as yet impossible to identify clearly the relationships between the control variables and the likelihood of jumps other than in a probabilistic sense, it can be suggested that behind the stochastic nature of the above discussion, lies an economic rationale. Clearly it is important to have some notion of whether any jump is likely for the organisation (or business or idea). Most writers focus on the tendency of organisations to execute the jump while on the downward slope of the curve. This researcher contends in this contribution that it is precisely this tendency that causes the failure of organisations to execute a successful transition from the old to the new.

From an organisational perspective, leaders should continually question the conditions and states of their systems. These may include questions like:

- What are the benefits the organisation is trying to realise?
- Are the actions taken realising the planned objectives or are they becoming an end in themselves?
- Does management have a clear vision as to where and when the reorganisation is intended to stop?
- What is good about the current state and conditions and how may these be preserved?

At a higher level, three important driving forces behind the organisational structure are [Finlow-Bates, 1993]:

- Information flows,
- the need for policy consistency and
- speed of reaction.

Changes in these variables may lead to a change in the relationship between the centre and the periphery of an organisation. Most systems (business or governmental) are still tied to the almost universal principle that all members should report to a single point of line responsibility. This is contrary to emerging organisational structures (Module III) which will have more natural structures as a result of technology. Finlow-Bates suggests that reduction of single point responsibilities (and the resultant waste of resources and energy) produces a more stable, yet flexible structure that could be allowed to adapt steadily to a changing environment rather than by a series of dislocating quantum jumps. Thus organisations could move from the line CD in Figure 6, onto line AB. In deciding how much higher in the organisation command lines meet, one could fine-tune the amount of centralised control aspirations.

The relationship between the concepts outlined above and the life cycle approach of any organisation (or business) needs to be explored in more quantitative detail than it was accorded in this thesis.

4.4 MANIFESTING THE CHANGE

The jump in Section 3 can be successfully orchestrated if any of the following four principles (or cultures) are adhered to [Imperato and Harari, 1994]:

- An innovative culture,
- a culture of coherence,
- an organisational culture of putting the customer first, and, most importantly,
- a culture of re-engineering technology.

These are expanded upon below.

(i) *An innovative culture:* Successful organisations focus continually on tomorrow's markets. They encourage risk and creativity in order to change the status quo and create new structures and processes. It looks '..*a customer ahead*' [Imperato and Harari, 1994:25] by continually preparing itself for obsolescence.

(ii) *A culture of coherence:* An organization that jumps the curve needs an instrument to bind it together. It needs *shared values* in an order where diversity will in fact induce creativity and innovation. It is important that leaders reward those who support the new organisational values and priorities [Refer to Table 32 and Figure 42].

(iii) *An organisational culture of putting the customer first:* Commitment to the customer must be genuine and shared. Tomorrow's leader has to bring a spirit of responsibility to replace expedient and self-serving attitudes. Customers form the primary stakeholder group, employees form the second stakeholder group and the organisation should regularly assess attitudes and satisfaction levels and perceptions for all stakeholder groups.

(iv) *A culture of re-engineering technology:* Jumping the curve means building the organisation around technology in order to increase productivity in a leader-led commitment to day-to-day organisational renewal.

In creating change one needs to develop a new philosophy that fits the strategic intent and organisational structure better, possibly including significant training, education and structures. These should focus on creating an organisational environment (or culture) in which people's behaviour and performance are aligned with the values and ideals envisioned by the company. This will be the subject of Module V with the proposal of the change models. Putting such a system in place could take months or years, since *creation is often easier than transformation*.

5. SECOND CURVE ORGANISATIONS

Moving from the machine metaphor for an organisation, Imperato and Harari [1994] contend that organisations have to become *intelligent*. Although organisational structures will be explored in Module III, it is important to note that information flows and associated processes have to be used as an organising principle. Thus they contend that an organisation may expect dramatic improvements in building itself and its software around the customer. This aspect involves more than a 'design for technology'-mediated organisational structure. It acknowledges that there is replacement of the old ways of doing business. From organisation as machine, the metaphor moves to continual innovation, flexibility and speed. Thus the new organisation must efficiently tie together interconnectivity, permeable boundaries and the importance of intangibles. Therefore second curve organisations have successfully and effectively negotiated the transition from mass (customisation) to brain and intelligence. Second curve organisations are leaner and more flexible, while enlarging their intelligence and knowledge base. There may be limited numbers of people but unlimited information and intelligence. The second organising principle (namely, feedback) thus becomes [Imperato and Harari, 1994: 142]:

> '*Building the organisation around the software* [or processes] *and the software* [or processes] *around the customer.*'

This entails far more than simply integrating technology. It also refers to the organisation's processes and systems for enhancing responsiveness. It entails building the organisation around the software, it means organising production and work around knowledge. Building the software around the customer, on the other hand, effectively makes the customer the central focus.

The purpose of the above-mentioned self-organising principle is to make the organisation into an intangible knowledge reservoir which holds the collective knowledge and intelligence of all its members. The capacity for renewal is seen as a function of intelligence and openness, whereby the organisation should continually learn.

The transition from mass to brain described above makes aggressive use of IT in four distinct initiatives. These are:

- Leveraging knowledge across the organisation.
- Accelerating the development of collaborative work within the organisation and between organisations.
- Prioritising efforts that lead to mass customisation, slender marketing and individualised customer sets.
- Liberating the people from the constraints of the paper-dependent environment.

Organisational forms that will achieve these maxims are discussed in the subsequent Module III.

6. CONCLUSION

The shift from the Industrial to the subsequent Quantum Age has significantly altered the nature of the workplace, the worker and, therefore, the work. Industrial era workers were located primarily in urban factories where they engaged in routine work, often on an assembly line. They worked a specific shift, punched a time clock and performed tasks under close supervision. A good worker was one who was reliable and passive, capable of modest dexterity.

In contrast, due to modern technology, Quantum Age workers can be located anywhere and can conduct much of their work any time. For example, a telecommuter can be at home for children after school and make up for such time during the evening. The prized worker is one who learns quickly and continuously, who works collaboratively and who is comfortable in an environment of risk and experimentation. The new knowledge workers generally perform their work without supervision. Those who are engaged in collaborative efforts do so as members of self-managed teams.

The two worlds described here cannot operate effectively under the same set of guiding principles. The emerging Quantum Age enterprise, called the 'chaordic enterprise' in this thesis, will be discussed in the subsequent Module III.

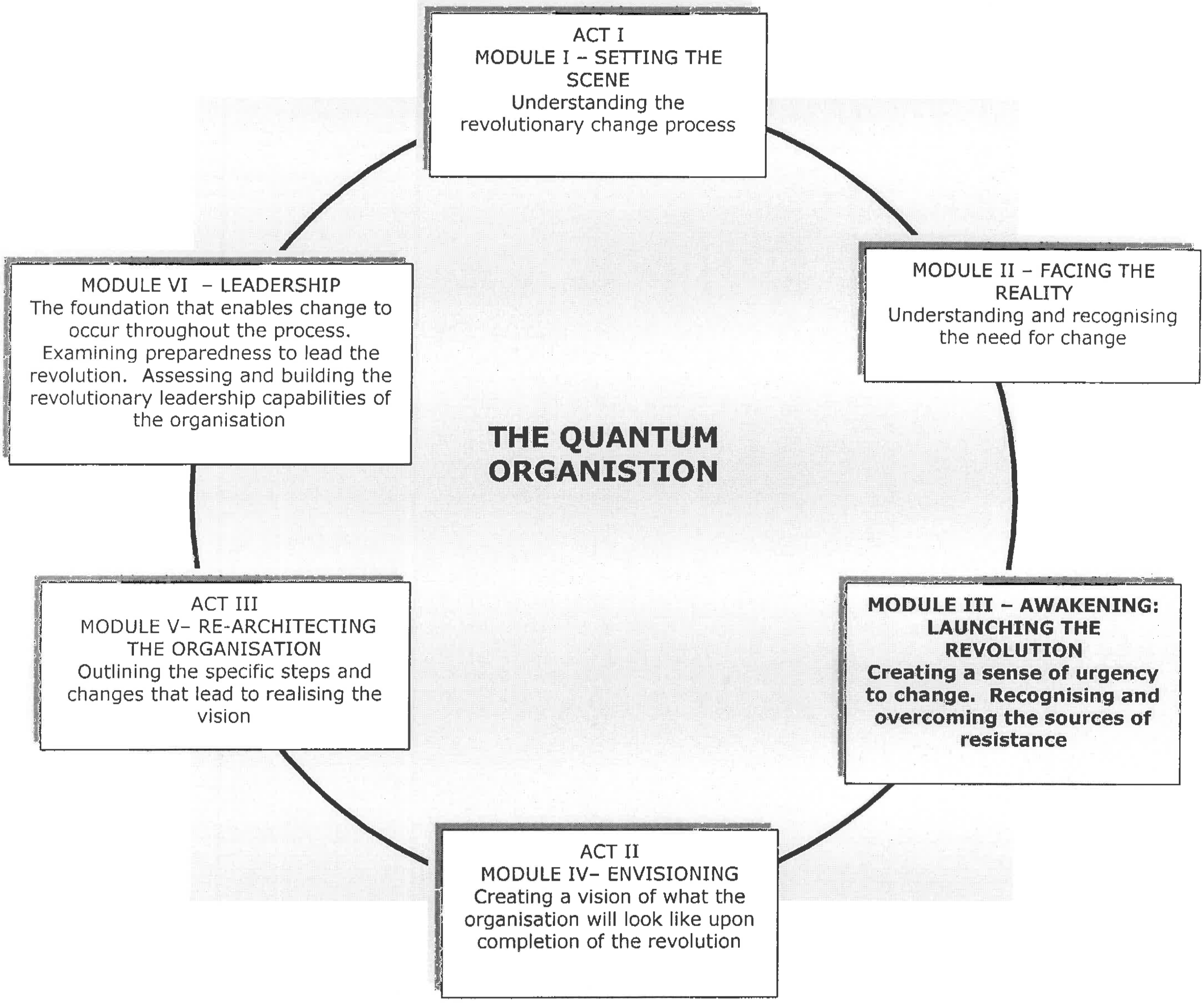
'Wisdom is about living harmoniously in the universe,
which is itself a place of order and justice that triumphs over chaos
and employs chance for its ultimate purpose.'

Matthew Fox

MODULE III – AWAKENING: THE EMERGENCE OF THE CHAORDIC ENTERPRISE

' At present we believe we are forming the happy state, not by selecting a few by its members and making them happy, but by making the whole so. Do not suppose that we ought to make the eyes so beautiful as not to look like eyes, nor the other parts in like manner, but observe whether, by giving to every part what properly belongs to it, we make the whole beautiful.'

Plato: 118



MODULE OBJECTIVES

Organisational structures pertaining to the knowledge era are studied. The dynamics of the environment inside and outside the organisation consists of forces that change the very being of the organisation. It becomes a living entity, having a brain and intelligence. These proposed structures are not necessarily new - their proponents have been expanding on these disciplines for some time, however, their implementation certainly is.

The focus of these proposed organisational structures is the notion of the chaordic enterprise (from chaos to order) based on the principle of self-organisation. The use of a single (fixed) organisational structure is questioned in the light of the living entity organisational phenomenon.

The metaphor of the quantum organisation, whereby the business organisation of the future is seen as a living web, moving beyond the clock-like machine paradigm is proposed and explored. This central metaphor, it is submitted, views the organisation as an organic web of dynamic and evolving network of relationships, the primary tenets which are wholeness, balance, connectivity, co-operation, creativity and open possibilities.

1. INTRODUCTION

With the advance into the knowledge economy, the basic assumptions underlying much of what is taught and practised in the name of management are hopelessly out of date [Drucker, 1998b]. Few policies remain valid for as long as twenty to thirty years, nor do most assumptions about technology. However, most of the assumptions with regard to business, technology and organisation are at least fifty years old. Drucker questions whether they have not subsequently outlived their usefulness and time [Section 1.2]. Business gurus are teaching practices and policies that are increasingly at odds with the changing realities and are in fact counter-productive. Drucker continues by questioning the basic assumptions about reality which he sees as the paradigms of social science, since these determine what the disciplines focus on.

One of the most insightful of the early management scholars, Mary Parker Follett [1868-1933] preached the use of conflict to create understanding. For decades her work was largely ignored since her assumptions differed from the management disciplines prevailing in the 1930s – the reason being that, at that time, Marxism prevailed in terms of which class conflict was deemed unresolvable. Moreover, this was the era in which cost cutting was believed to be the essence of good management.

1.1 THE ORGANISATION OF THE FUTURE

Within the extended boundaries of fierce global competition, changing markets and technological breakthroughs, the following distinct characteristics emerge for the organisation of the future.

These are [Champy and Nohria, 1996]:

- Information-based,
- decentralised, yet densely linked through technology,
- rapidly adaptable and extremely agile,

- creative and collaborative, with a team-based structure,
- staffed by a wide variety of knowledge workers and
- self-controlling on the basis of shared operating principles and real trust.

This author disagrees with the team-based approach listed above and feels that the focus should be more on the notion of collaborative groups forming and disbanding according to the needs of the organisation (similar to the principle of self-organisation in Module II). Kepner [Kepner and Iikubo, 1996] prefers the notion of collaborative learning, whereby the problem is first identified, after which members are called upon to resolve the issue. They believe that it should be the *problem* that holds them together, even if they do not usually work together. In team-building, they maintain, members are thrown together from the start and not necessarily because of the problem and their problem-solving capabilities for the problem at hand. Centralised organisations have become too slow, too costly and too inefficient [Champy and Nohria, 1996].

1.2 MANAGEMENT PARADIGMS FROM THE PAST

The management sciences constitute a form of social science. Thus it deals with the behaviour of people and human institutions and, consequently, with the notion of change [Drucker, 1998b]. There are no natural laws as in the physical sciences. Assumptions that were valid in the past are rendered obsolete and become misleading in no time.

Drucker [1998b] cites the following assumptions that he believes are leading management astray in the modern time:

- Only one correct form of organisation exists today (theories about the right organisation have changed several times, but management practitioners still cling to the assumption that there is a single form of organisation for every business).
- The principles of management apply only to business organisations.

- There is a single correct way to manage people – for example top-down, centralisation, decentralisation or the (collaborative) team approach, to name a few.
- Technologies, markets and end-users are fixed and rarely overlap. Hence each industry has a specific technology and specific market.
- Management's scope is legally defined as applying only to an organisation's assets and employees.
- Management's job is to *run the business* rather than to concentrate on what is happening outside the business – an internal rather than an external focus.
- National boundaries define the ecology of enterprise and management.

Drucker reiterates that there is an incorrect tendency to confuse *management with business management*. The first refers to the term 'manager' in the context of the city manager – an American invention of the early years. The identification of management with business management began only with the Great Depression, which bred hostility and contempt for business executives. In the post-war period the fashion changed, and in 1950 business had become a good word – largely due to the performance of American business management during World War II.

The reason for the importance of the divide between the above notions become clear when one realises that, unlike the Second Wave in which the working population lived off their economic activities, the growth sector in the next wave will in all probability be that of business – especially that of the non-profit sector [Drucker, 1998b].

1.3 THE MYTH OF A SINGLE ORGANISATIONAL STRUCTURE

Organisational structure was first studied in France around the turn of the century by Henri Fayol, the head of one of Europe's largest (but totally disorganised) enterprises. Large-scale enterprises were emerging and their managers had to evolve their own disciplines as they went along. World War II made clear the need for a formal organisational structure. It also showed that

Fayol's functional structure was inappropriate for massive undertakings. This paved the way for Du Pont's and Sloan's notion of decentralisation. This was followed by the team approach and, consequently, the rational approach that preaches *collaborative* decision-making. Drucker himself [1998a: 98] criticised management as becoming fashion-conscious:

> ' .. *managers implement strategies like downsizing and re-engineering just because they seem the thing to do.'*

He continues to cite the emphasis on teams as perhaps the worst example

> *'It takes years to build a successful team, but companies are rushing into it and expecting instant results. In most cases teams do not even work. Teams are difficult to manage..'*

There is no such thing as one correct organisation. There are only organisations, each of which has distinct strengths, distinct limitations and specific applications. Organisation is a tool to make people productive in working together. As such, a given organisational structure fits certain tasks in certain conditions and at certain times. One example is the much touted end of the organisational *hierarchy*. Drucker [1998b] does not see this ending as is generally believed, since there should always be some final authority. He maintains that this final authority and its unquestioned acceptance by everyone in the organisation, is the only hope in crisis. What this correct form of organisational structure is (according to the nature of the tasks, industry or nature of the business) may vary even within the same enterprise. In any enterprise (even manufacturing) there is a need for a number of different co-existing organisational structures. These may range from complete local autonomy to total centralisation.

2. UNIVERSAL PRINCIPLES OF AN ORGANISATION

Although there are vast differences in organisational structure depending on the nature of the task, there are also some universal principles any organisation should heed.

These are suggested below:

- Transparency,
- hierarchy in the form of authority to take command in crisis,
- knowledge and understanding of the organisational structure by all,
- flat(ter) organisational structure,
- erasure of technological boundaries and, finally,
- customer value.

These are expanded on below.

(i) *Flatter organisational structures*: In the Information Era, it is a sound organisational principle to have as few structural layers within the organisation as possible. Drucker's [1990] post capitalist society suggests specialist workers and re-engineered work.

(ii) *Erasure of technological boundaries*: The textile industry of the Second Wave that developed out of the then cottage industries had its own unique technology as had the coal mining industry and other industries that arose in the 18th and the first half of the 19th century. In fact, these technologies of the various industries did not overlap at all. In the 19th and the beginning of the 20th century, it was assumed that technology was industry-specific and that technologies outside of one's own had little or no impact on one's industry. One needed an understanding of one's own technologies and nothing outside of one's own industry.

One of the first to recognise the limitations of the latter approach was Werner von Siemens, who built one of the first large-scale industrial organisations. In order to obtain a competitive advantage in his industry's technology, he hired the first university-trained scientist to start a modern research laboratory. Out of this grew the German electrical and chemical industries, gaining worldwide leadership through technology. This in turn, led to the creation of all other major companies besides chemicals, for instance automobiles, the telephone, pharmaceuticals and computers. The limited view of technological boundaries almost led to the downfall of Bell. They failed to see that the world had changed and that the technological barriers between industries had fallen.

The following are some examples of the breaking down of the barriers: The *automobile industry* which is increasingly becoming more and more dependent on electronics and on computers; the *steel industry* which has become more and more dependent on material science; and the *pharmaceutical industry* which is becoming more and more dependent on microbiology, molecular biology and medical electronics.

Modern technology extends beyond industry barriers and organisations should have a grasp of the sheer force of technologies that are outside of the existing field. Walls that defined industries are tumbling. Where once, companies competed within an industry, industries are now competing *with* industries [Drucker, 1998b]. There is displacement of natural monopolies. He [Drucker] believes that computers evolved from an engineering tool, to data storage to part of modern communications. Management should realise that there is no longer a unique technology pertaining to a specific industry and that end use is no longer supplied by a specific and unique product or service. Drucker [1998b: 168] explains

*'We have finally come to realise that the want is unique,
but the means to satisfy it is varied. The business management
that forgets that is not long for this world.'*

The most significant example of this, is undoubtedly the *credit card* (also known as M1 – Money One) as the fastest growing source of commercial credit – not the commercial or investment banks. With this technology, customers are capable of obtaining and maintaining a level of credit far exceeding their own creditworthiness. Through its extensive usage (despite the fact that the cost of credit is generally expensive), it has become the new form of money.

(iii) Customer value

Today's market leaders understand the battle they are engaged in. They know they have to refine value by raising customer expectations. Treacy and Wiersema [1995] believe that an organisation needs discipline to become a market leader and to maintain that position. They follow on the ideas presented by Hammer and Champy [1990] for organisations to redesign the way they do work or '*How to run the race*'. They [Treacy and Wiersema] present a '*What race to run'* scenario. They redefine business competition by teaching organisations how to relentlessly drive themselves to extraordinary levels of distinctive value that will make it impossible for other organisations to compete on the old terms. They show how failure to recognise and adapt to this new competitive reality, will make businesses succeed or fail in the Information Era. In this, they have identified three distinct value disciplines (or dimensions), each producing a different kind of customer value.

The value disciplines are [Treacy and Wiersema, 1995]:

- Operational excellence,
- product leadership and
- customer intimacy.

These are schematically represented by the following figure.

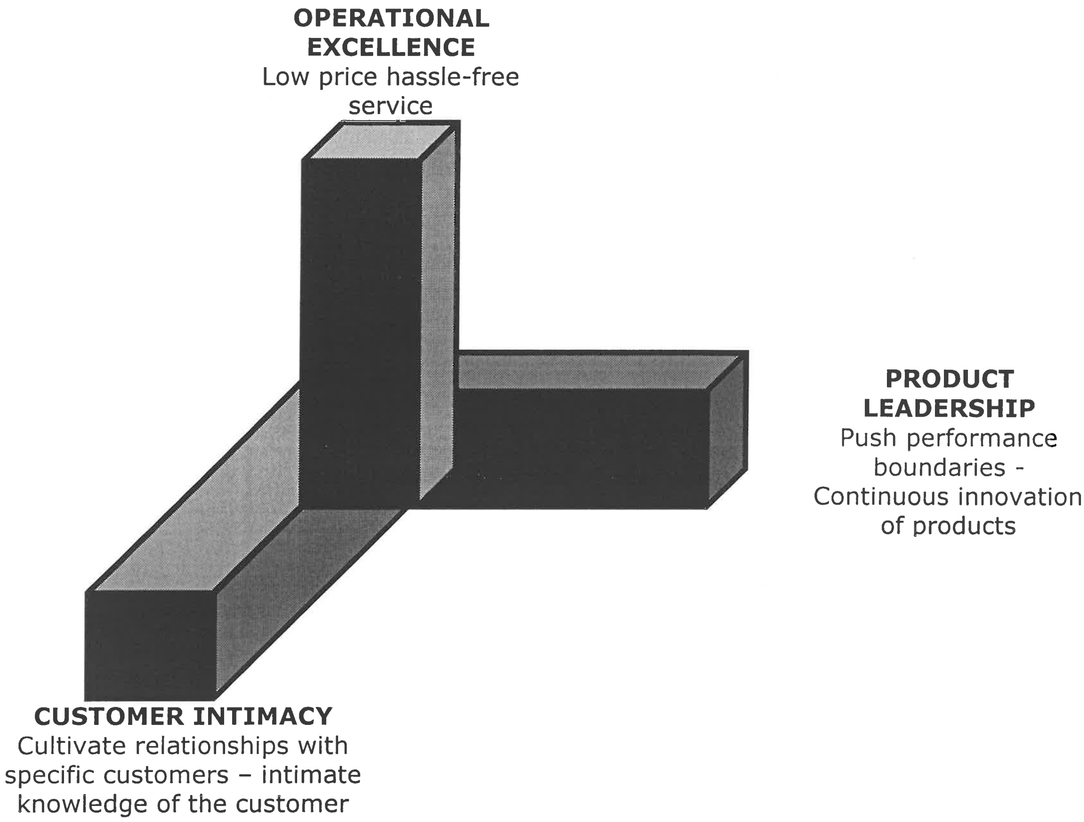


Figure 9: The value disciplines
After: Treacy and Wiersema, 1995

(i) *Operational excellence:* Organisations that pursue this dimension are not primarily focused on product or service innovators, nor do they cultivate deep, one-on-one relationships with their customers. They provide middle-of-the-market products at the best price with the least inconvenience.

(ii) *Product leadership*: Its practitioners concentrate on offering products that push performance boundaries. They offer the best product. They continually innovate. They continually redefine the state of the art.

(iii) *Customer intimacy*: These organisations focus on the specific needs of specific customers and not necessarily what the market wants. They cultivate relationships. They satisfy unique needs which they recognise through their unique relationship with their customers. They provide the customer with a total solution.

Time is an important component of value. Technology redefines the value of time and redefines customers' expectations. Moreover, customers penalise suppliers who infringe on their time through delays, mistakes or inconveniences.

Choosing one discipline to master, does not mean that an organisation abandons the other two – only that it selects the value dimension in which it wants to achieve market leadership and subsequently maintains a competitive threshold in the other two dimensions. This is not an arbitrary decision, but is based on extensive analysis of the organisation and its market (current and future). Treacy and Wiersema maintain that this selection of a value dimension is not the same as choosing a strategic goal. Rather, it defines what an organisation does and what it is. It entails adherence to the value discipline. Superiority in one dimension should not be equated with backsliding in the others. Indeed, the organisation should strive towards parity with its competitors in the other two dimensions, whilst retaining its competitive advantage in the first.

To choose a value dimension (and hence its operating model) is to define the very nature of its being. The value dimension shapes the organisation's operating processes, business structures, management systems and culture. Different value dimensions demand different operating processes and different technologies. These are summarised in Table 5 below.

Table 5: Examples of South African companies and the value dimensions they favour

VALUE DIMENSION	DRIVING FORCE	CORE PROCESSES	ORGANISATIONAL STRUCTURE	MANAGEMENT SYSTEMS	SOUTH AFRICAN EXAMPLE
Operational excellence	Speed and consistency in delivery	End-to-end supply, customer service, demand management. Standardised, simplified, tightly controlled and centrally planned leaving few decisions to employees.	Empower employees who can make a difference in producing value.	Focus on integrated, reliable, high-speed transactions and compliance norms. Culture abhors waste and rewards efficiency.	ESKOM McDonald's, SA Coca Cola, SA
Product leadership	Leading edge products/ services	Creativity, speed. Render their own technology obsolete. Market exploitation.	Loose structure. Ad hoc. Ever changing to adjust to entrepreneurial initiatives and redirections that characterise working in unexploited territory.	Results driven. Measure and reward new product success. Do not punish experimentati on Culture encourages individual imagination and a mind set that creates the future.	Siemens, Pty Ltd Standard Bank, SA SAMSUNG LSG
Customer intimacy	Solution development, results management and relationship management	Advisory services and relationship management.	Delegates decision making to employees that are closer to the customer.	Geared towards creating results for carefully selected and nurtured clients. Culture embraces specific rather than general solutions and thrives on deep and lasting client relationships.	ABSA Private Bank NEDCOR Woolworths Pty, Ltd. Toyota, SA

The consequences of this new form of operating model are legion. For example:

- Organisations will turn to others in order to help design and run parts of their operating model. This should lead to an increased demand for new organisational connections in the form of outsourcing, joint ventures and strategic alliances [Treacy and Wiersema, 1995].
- The workforce will be re-energised. New insights gained from value creation will encourage innovation. This should also provide relief from the demoralising effect of downsizing. There will be renewed optimism and purpose.

Technology is a driving factor in every one of these dimensions. The role of technology will be discussed below.

(i) *Technology in the dimension of operational excellence*: Technology is especially important in operationally excellent organisations. The IS (related databases and applications) will provide an understanding of the core business processes. These systems are so highly automated that they not only track the process, they contain and perform it. The power of IT is especially evident in industries like the insurance sector and the health care sector. For instance, EDI has brought to these businesses an entirely different operating model built on a sophisticated base of IS and automated IT that has substantially reduced the organisation's cost structures. The reason that not all businesses follow suit, possibly lies in these organisations' inability to adapt to the organisational demands made by IT. It is suggested that, without organisational discipline or a centralised, regimented and standardised structure, state-of-the-art computer systems alone, will not provide competitive advantage.

Real time, hassle-free service, comes only through the speed and integration of IT solutions (refer to Module IV).

Advantages of leading-edge technology include:

- Better operational efficiency and control.
- The information contained in integrated computer systems is not only useful in the core operating processes, it also enables the organisation to measure and monitor quality and cost.
- Detailed information is generated for better decision-making.
- The pursuit of mobile technologies to extend control and improve customer service (like notebooks, cellular phones and fax modems).
- The systems manage the process. Databases offer profiles of customers.
- Expert systems screen and grant customers credit.
- Telemarketing conducts analysis faster and more efficiently.

(ii) Technology in the dimension of product leadership: Technology is of importance in organisations pursuing the value dimension of product leadership. Thomas Edison probably pioneered the idea of automated process innovation in his attempts to store electricity, saying [Treacy and Wiersema, 1995]:

'Genius is 1% inspiration and 99% perspiration.'

Edison's laboratory became the model for today's product leaders like Sony and Microsoft. Edison's idea of product leadership involved an organisation displaying the ability and determination to make products that customers recognise as superior – and an organisation that could deliver real benefits and performance improvements. A good example is Microsoft presenting software that enables the customer to automatically update figures in four applications while working in one – WORD word processing, EXCEL spreadsheet, PowerPoint presentation and ACCESS database.

Product leaders in high technology industries focus on devices that are smaller, faster, lighter, cooler and cheaper while at the same time capable of better performance. They continually strive towards planned obsolescence. An example of this, is INTEL in the microprocessor industry. They believe that they should:

'Double the machine performance at every price point every year.'

Andy Grove, CEO, INTEL

At INTEL there are always multiple teams working on subsequent versions of the product. When the 486 chip was just entering the market in 1989, a new team was already developing the concept for the fifth-generation chip, the Pentium. Another team is at work on the P-7, the seventh-generation microchip. Their initial Pentium chip had INTEL stretching to the limits of chip-making technology.

The organisation combats competitors through:

- Designing chips with more features and, moreover,
- pushing the limits of its manufacturing technology.

One reason for INTEL's success is its optimal use of high performance (or ad hoc) teams that cross all boundaries. There is a culture of shared learning (see this author's earlier comment with regard to collaborative teams).

(iii) *Technology in the dimension of customer intimacy:* Organisations that focus on the value discipline of customer intimacy need a deep and specialised knowledge of their customers and of the market. They use their clients to stay on the cutting edge. Logistics, marketing and IT are areas in which expertise has become deeper, more specialised and ever-changing. There is a general institutionalising of knowledge for competitive advantage.

2.1 THE PROBLEM WITH SCIENTIFIC MANAGEMENT

When Frederick Taylor started what later became known as Scientific Management, he looked at management from a *'How is it done?'* (efficiency) perspective. Fifty years later Elton Mayo replaced Scientific Management with what has become known as the Human Relations Model (See the history of the management model in Module V – especially with reference to Figure 26). Neither of them asked

'What should the task be?'

It was left to Peter Drucker [1992: 85] to answer:

'It is not to predict the future. It is to give our business direction and goals, as well as the strategy to attain those goals' (an effectiveness perspective).

Taylor did not cite business as the perfect example of Scientific Management, he cited the non-profit Mayo Clinic. The most publicised application of Taylor's Scientific Management (though aborted through Union pressure) was not in business but in the government-owned and –run Waterton Arsenal [Drucker, 1998b].

2.2 THE NEED FOR NEW ORGANISATIONAL STRUCTURES

Employees of the Information Wave will have to learn to operate within different organisational structures simultaneously. The leadership of the future will require a toolbox of varying organisational structures, some highly specialised, from which to select the appropriate one for a specific task. They will need to be able to use each one properly and to think in terms of mixed structures rather than pure structures alone. Few organisations have the ability to do this.

The organisations of the Information Wave need a different set of rules to stay competitive. The new organisational model can no longer use the existing models and paradigms from the past, since it is clear that the environment is changing at such a rapid pace, that the past and all its rules cannot predict the future. Organisations will need a more external futuristic focus to sustain themselves.

Handy [1989: vii] suggests:

'The future is not inevitable. We can influence it, if we know what we want it to be. ..We can and should be in charge of our own destinies in a time of change.'

and

'Change is not what it used to be.'

as well as

'Those who know why changes come, waste less effort in protecting themselves or in fighting the inevitable. Those who realise where changes are heading are better able to use changes to their own advantage.'

Handy, 1989: 4

Handy [1989] believes that continuous change is comfortable change and cites as justification for this that the past can then be used as a guide to the future. Arguably the biggest discomforter is the evolution of technology.

McGregor's [1960] assertion that management has to choose between one of two different ways of managing people (Theory X and Theory Y) was proved wrong by Maslow [1962] when he proved conclusively that people have to be managed according to their needs (from basic needs to self-actualisation). This underlying notion that there is only one way to manage people, is fundamental to all other (erroneous) assumptions about people and their management. Examples of these include: 'People work full time'. 'People are dependent upon the organisation for their livelihood'. These examples are even more appropriate with regard to the IT environment and the so-called knowledge workers. Knowledge workers cannot be managed as subordinates – they are associates, since they know more about their job than their bosses do. This entails leading employees (as opposed to managing them), thus maximising their performance by capitalising on their strengths and their knowledge rather than forcing them into moulds.

3. TOWARDS A CHAORDIC SCIENCE PARADIGM

At the dawn of the Third Wave, contemporary models of thought reveal themselves to be less than adequate for the task of making sense and surviving in the turbulent and uncertain business world. As a result, managers are prone to react to the spiralling complexity and flux with actions designed to impose control and enforce unwavering stability. Not only do these 'equilibrial' schemes prove futile and costly, they ultimately sap the system's ability to rise to ever higher levels of coherence.

In this fast-changing new world, the greatest resource leadership can expand on is the mind-boggling discoveries of modern science. These go beyond Isaac Newton's classical sciences and are inordinately more powerful. Fitzgerald and Van Eijnatten [1998] believe this to be due to the efforts of modern theorists and practitioners who continue to boldly push the existing boundaries of scientific knowledge and theories. Organisations now have an unprecedented opportunity to *see* what has been impenetrable up to now. Those who learn how to tap the vast potential inherent in this deeper vision of organisational reality, should ultimately boost their organisations' capacity for change and learning by an order of magnitude.

3.1 THE EMERGENCE OF A NEW PARADIGM

Can chaos theory provide appropriate methods and metaphors for understanding the new world of work? Does the notion lend itself to the self-organisation of people in organisations? Is there utility in chaos and complexity theory which could add to or even supplant the Newtonian order?

Fitzgerald and Van Eijenatten [1998] identify the following assumptions of classical management thinking:

- *Empiricism* stems from a belief that *the only true reality is that which may be known by the five senses.* In business terms this refers to leadership's considerations of bottom line, headcount and other concrete measures.

- *Reductionism* demands that every object be precisely equal to its parts. It entails *fragmenting the system (especially complex ones) into parts* as a simplification measure.

- *Determinism* asserts that every event is a cause ultimately producing a singular effect which, in turn, becomes the cause of a subsequent effect and so forth. This belief focuses on the idea that *there is but one future which, on top of everything else, has been pre-ordained by its initial conditions*. This is best seen in leadership's view of strategy as incontrovertible.

- *Conservatism* arises from the notion that unlimited progress is the just reward for retaining the status quo. This strongly held belief wishes the prevailing order of equilibrium to be sustained indefinitely. Leadership follows the notion of not fixing anything unless it is broken, or maintaining it to destruction.

- *Interventionism* is fostered by an ominous belief that every opportunity should be taken to change the system – for the change's sake. This corresponds to hands-on management that has little long-term effect. (Refer to the comment regarding the existence of two parallel business solutions in the Prologue).

This drive towards a so-called 'holonic' enterprise, the authors [Fitzgerald and Van Eijenatten] believe, have a threefold aim:

- To relinquish the sense of certainty and control derived from their long and gainful association with the credo of Scientific Management.
- To expose the dangers inherent in retaining the pervasive meta-model, the so-called 'equilibrial' mind set.
- To identify the managerial process in the new order.

The world of work is changing because the organisation of work is changing their ways. Simultaneously, organisations have to adapt to a changing world of work. It is evident that organisations will face a tougher future than they have been used to. Moreover, the organisations of the future will not necessarily be institutions providing employment. This in part already reflects the notions of discontinuity discussed above. Handy [1989: 71] believes that

> ' ..70% of all jobs, and perhaps half of those brain skill jobs will require professional qualifications or education up to university level.'

Such employees have to be managed differently. Furthermore, strategic alliances are forming among even unlikely partners. National (and political) boundaries do not define the new business environment, since technologies circumvent conventional boundaries [Drucker, 1998b]. Organisations increasingly organise themselves by businesses rather than geography. Through the global economy, car engines may be manufactured in one country, bodies in another and the electronics in yet another - making the cars themselves (not just the company of origin) multinational. Management and national boundaries are no longer congruent and the scope of management can no longer be politically defined. The question that Drucker [1998b: 173] poses in this regard is this:

'What is the nationality of a transnational?'

For management, this poses new problems. Resultant issues that have to be addressed include:

- Relationships among the different units,
- how to work together,
- the jurisdiction of each,
- conflict resolution and
- where the domain of management is located.

The solution to this new diversity and complexities of the knowledge society lies in part in the realisation that forces that significantly influence the organisation, are more from the outside rather than from within, having a more entrepreneurial focus than ever before. This is further substantiated by Hamel and Prahalad's [1994] so-called 40/30/20 rule – 40% of executives' time is spent looking outward, 30% peering three to four years into the future and 20% is spent attempting to build a collective view of the future. They argue that on average, management consequently spends less than 3% (40%x30%x20% = 2.4%) of their time building a corporate perspective of their future as a business. It takes substantial and sustained intellectual knowledge and energy to develop mental models for the future. They continue to suggest that leadership does not take cognisance of the future simply because they believe that, by doing so, they have to admit that they are not in control and lack the knowledge and skills to explore the unknown.

The following schematic presentation illustrates these perspectives.

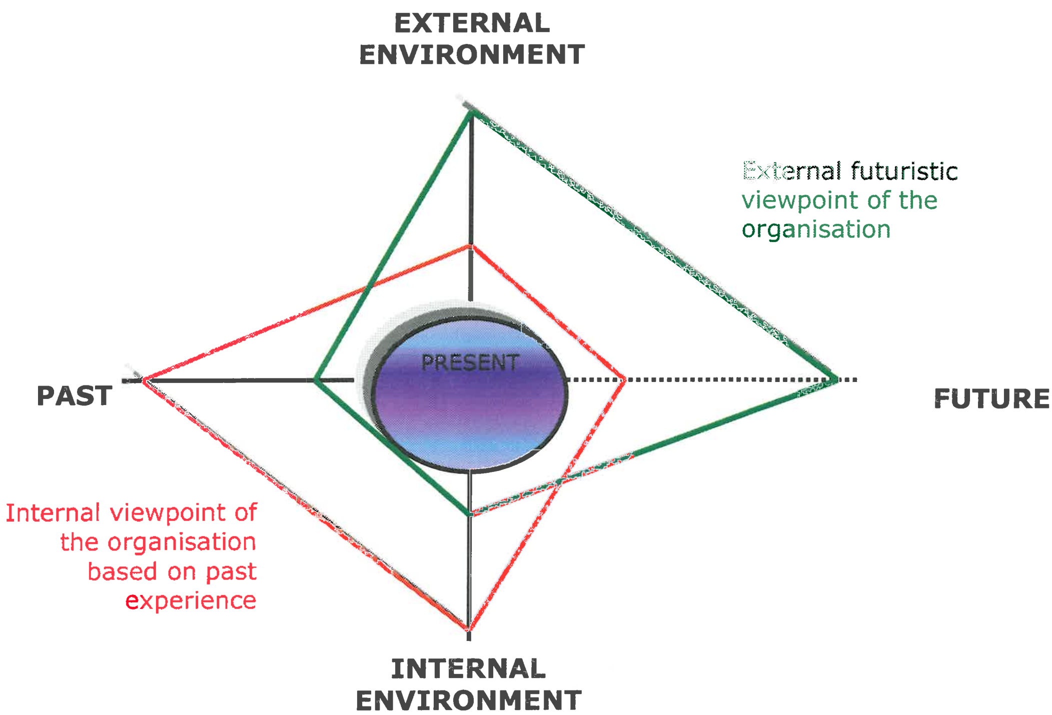


Figure 10: Schematic presentation of transforming from inward looking (focusing on the past) to outward looking (focusing on the future)

It is Drucker's [1998b] contention that this inward focus of management is *aggravated* (rather than alleviated) by the rise of IT. It has proved itself as the vehicle to obtain information – but from an internal perspective. For example, a transactional accounting system (like SAP), is designed to record and report internal data, but fails to report on the external environment. Generally IT conferences focus on showing customers and users how to obtain more data within the organisation. Management, on the other hand, has to make meaningful and strategic decisions from an external perspective. It is predicted that the main challenge for IT will be to enter the arena of collecting and reporting external information in an orderly and systematic way, and indeed in this researcher's opinion, also in a systemic way. (The systemic challenge refers to the evolution of IT from data processing through back-room applications to its emergence as a strategic and competitive tool. (See Figure 18 in Module IV.) As can be deduced from Figure 10, the systemic perspective provides the organisation with the external, futuristic element that it so badly needs.

Management's main thrust in preparation for the Information Wave, will be the organisation of organisational resources for results outside the organisation. This will be the focus of Module V.

Drucker [1998b: 175] believes

'.. the center of a modern society, economy and community is not technology.
It is not information. It is not productivity.
The center of modern society is the managed institution.
The managed institution is society's way of getting things done these days.'

It is suggested here that Drucker's point of view above is too simplistic and gives no real insight into resolution. The answer lies in all of the above – at the same time and in differing degrees. This is difficult to achieve. Getting it right will depend on the right tools and styles – some of these will be addressed below.

3.2 THE LOOK OF THE CHAORDIC ENTERPRISE

In this new kind of organisation, a dynamic balance between chaos and order exists as a result of the specific leadership provided. The more this system remains in balance, the less it will resemble the classic organisation of the twentieth century. Table 6 below summarises this enterprise design. From this, it is clear that the 'chaordic enterprise' evolves towards a vibrant, collaborative, team-based network in which the locus of control is internalised and not the responsibility of management.

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Table 6: Blueprint of the dimensional design of the chaordic enterprise

DIMENSIONS	DESIGN FEATURES OF THE CHAORDIC ENTERPRISE
Metaphor	Amoebae colony
Intention	To advance the quality of organisation and human life
Governance	Personal responsibility/accountability
Control	Guided autonomy
Measurement and reward systems	Both quality and value added
Structure	Adhocracy/team-based network
Selection	Diversity of life-long learners
Leadership	Emergent
Managerial role	Diffused self management

Source: Fitzgerald and Van Eijenatten, 1998

The above organisational model in many ways reflects the Competing Values Framework suggested by Quinn [1990] to be discussed in Module V (Figure 26).

Differing organisational structures applicable to the changing knowledge society will be discussed in the remainder of this module. These are:

- The Shamrock organisation,
- the Federal organisation,
- the Triple I organisation,
- the Self-organisation,
- the Hypertext organisation and
- the chaordic enterprise.

4. HANDY'S ORGANISATIONAL FORMS FOR THE INFORMATION WAVE

The organisations of the future, will have totally new structures indicative of the new styles in which they operate. It is suggested here that Handy's organisational forms for '.. the age of unreason ..' are applicable to the emerging Information Wave [Handy, 1995a]. It moves from the Organisation-as-Machine format to an organisation made up of the people, and the new resource that will create competitive advantage: Information/Knowledge – in itself a form of discontinuous thinking from the past. He proposes three forms developing alongside each other - focusing around the people as knowledge workers. These are:

- *The Shamrock organisation* – an alliance between different types of work and the workers
- *The Federal organisation* – almost like an inverse form of hierarchy and
- *The Triple I organisation* – focusing on the new form of wealth, namely knowledge and an organisation's ability to use the knowledge, corresponding to the learning organisation.

It is conceded that Handy's work can be viewed as dated since it was first printed in 1989. However, it is increasingly evident that these organisational forms are relevant in the changing global economy and should be striven after for competitive advantage. The focus is not on these organisational forms themselves, rather on their net effect on future organisational forms – like the virtual organisation.

Whether these structures are relevant in South African organisations is difficult to predict. Moreover, if indeed they are, the question remains whether South African leaders will have the strengths and opportunities to make them work.

4.1 THE SHAMROCK ORGANISATION

The Irish national emblem, the shamrock, is a small clover-like plant with three leaves and a stem. Handy [1995a] uses it symbolically to indicate that organisations are made up of three different groups of people, with different expectations, to be managed differently, rewarded differently and organised differently. He [Handy] suggests that each of the three groups of workers or workforces within the organisation are significant and that each exhibit a different kind of commitment to the organisation. There is also an emerging fourth leaf – another form of subcontracting – that cannot exist within the formal structures of the shamrock. This entails the growing practice of contracting to the customer to participate in certain tasks and roles. The organisational structure in the shamrock is flat with few levels and quick promotion.

The three (four) leaves are summarised in the following table:

Table 7: Summary of Handy's three leaves of the Shamrock organisation together with the fourth leaf (an informal element of the shamrock)

FIRST LEAF	Core workers	Well-qualified professionals, technicians and managers - essential to the organisation. They own the knowledge that distinguishes one organisation from another. They are the organisation. They are hard to replace, but expensive. Downsizing generally does not include them. Downsizing merely makes the core smaller.
SECOND LEAF	Contractual fringe (typically, IT)	These consist of both individuals and organisations. The individuals are self-employed, whilst the organisations themselves may be of the shamrock type.
THIRD LEAF	Flexible labour force	Part-time and temporary workers. Due to the growth in the service industry, they form the fastest growing element in the employment force.
FOURTH LEAF	Customers – another form of subcontracting	The growing practice of letting the customer do the work. Examples: Self-service shops and restaurants.

The Shamrock organisational structure has had particular application in the IT industry, with this function conventionally contracted out to specialists. With modern trends to integrate the IT and organisational strategies, this will have to be looked at. However, it does serve the modern trend of workforce flexibility. The leaves of the Shamrock denote recognition of the need for differences – in the workforce, in the organisation's needs and in managing the different leaves. This calls for a radical rethink of the organisation's basic functions and its vision.

4.2 THE FEDERAL ORGANISATION

The Federal organisation is emerging alongside the Shamrock to address the development of a variety of individuals. It promotes decentralisation from the centre to smaller units. New technologies (especially in IT) render a flow of information possible, even to geographically dispersed units in the organisation. The use of the Internet (especially the emerging Portal approach), the Intranet, the Extranet and telecommuting, creates a virtual organisation with businesses and business units across the globe being able to communicate and share information and run their business – almost adhering to the Just in Time principle.

Technology, especially IT, acts as the main driving force behind the Federal organisational structure. Through the use of IT, the creation of the virtual organisation or the virtual office is imminent.

The Federal organisation follows from the Shamrock with the growth of a bigger organisation (Shamrock) leading to more and smaller shamrocks. Using the capabilities of IT, these smaller shamrocks are managed, not from the core, but from the outsourced resources of the Shamrock. Consequently, these organisations have to decentralise – involving a radical rethink of the way they do their business.

4.3 THE TRIPLE I ORGANISATION

Moving away from the past waves and their focus on wealth measured in terms of ownership of land, the new focus in the emerging Information Wave is the competitive advantage of knowledge. Handy [1995a: 112] believes that adding value is a function of *intelligence*, *information* and *ideas* and the synthesis they create:

$$\text{Value added (VA)} = I^3.$$

To this end, he believes that some functions will not be automated and certain basic functions will always have to be performed. However, the core of the organisation focuses on learning and knowledge creation and application. This is called the 'intellectual property' of the organisation. Such an organisation sees employees not as workers, but as partners, specialists or leaders.

To assimilate this new accumulation of intangible wealth, organisations will use technology

*'We are depending on the technology to educate our people in abstract thinking .. you can no longer make a decision based on local data .. you have to derive your decision from the inter relationships among the variables;
You have to start thinking.'*

Handy, 1995a: 117

Organisations will need people to use the technology

'The new organisations need new people to run them, people with new skills, new capacities and different career patterns.'

Handy, 1995a: 119

and

'To get three times improvement the smart organisation will equip their people with all the technological aids they need ..'

Handy, 1995a: 119

In conclusion, it is of interest to note that Handy's organisational forms address the following:

- The value of the *worker* as a resource: Knowledge worker/specialist.
- The value of *knowledge* as a resource: Intellectual capital of the organisation.
- The value of *technology* as a resource: IT acts as an enabler and spur in changing business to achieve competitive advantage.
- Different structures to govern these resources: Flat, loose organisational structure, few levels (no middle managers, only leaders).
- Different *leadership* styles to govern these resources. Shared values, trust, collaborative decision making, networks.

The above lead to the new structure described below.

4.4 THE VIRTUAL ORGANISATION

Following on Handy's suggestions concerning the three organisational forms above, comes the Information Wave equivalent, the virtual organisation. A *virtual organisation,* in its widest sense, is a network of independent organisations (or businesses) that is linked together by IT to exploit market opportunities by sharing skills, costs and market access. It destroys business and geographic boundaries. A virtual office has no personal workspace for its employees; it is created according to need.

Managers are accustomed to think of organisations as stable physical entities, having physical locations such as head offices and operating units. Technology is driving organisations in a new direction, viewing them as systems rather than physical entities – or virtual organisations. According to Hope and Hope [1997] these organisations might indeed exist without physical elements, merely comprising virtual value chains and a knowledge structure that links virtual inputs with market needs. It has little or no proprietary assets, save its intellectual capital. Typically, such an organisation will consist of a small team using its knowledge infrastructure to co-ordinate market needs and channels with independent suppliers. One example could be to replace middle management with a centralised information platform (for example, Lotus Notes) that collects customer requests and relays these electronically to engineering teams working from home. There is closer communication between suppliers and customers up and down the value chain, thus reducing costs and cycle times. Non-strategic, peripheral operations are outsourced to external partners. The core competence is highly flexible.

Becoming virtual, gives a business a stronger position in knowledge-based leverage [Hope and Hope, 1997] than the competition. Successful virtual organisations invest heavily in their core capabilities (like the Shamrock). One example is that of British Airways. British Airways has become a virtual airline, owning advanced aircraft, focusing on its core competencies of transporting people and cargo. To this extent, the airline needs only own its route and its brand and yield an effective and efficient management system. It envisages real cost savings over the next three years.

The notion of a virtual organisation brings with it new challenges and difficulties, especially regarding the transient workforce. Handy [1995c: 41] poses the question:

'How do you manage people you cannot see?'

Trust is the critical element in the management of knowledge workers and the virtual organisation (the Shamrock and the Federal organisation). It is suggested here that care should be taken in deciding to what degree the organisation should become virtual.

Making use of knowledge workers across the globe as part of the virtual business can also be restrictive and deemed an impediment to the business. Hope and Hope [1997] suggest that knowledge sharing should also include *tacit* knowledge sharing, since it is this that enhances learning. They suggest a virtual social reality, supporting interactions that are richer and more focused than free-form electronic discussions – even the Worldwide Web. This should allow flexible participation with users participating as they see fit. What is created is a network place rather than an electronic space, with people interacting as a community, since

> ' ..*the most valuable knowledge often resides where we are least able to see or control it: On the front lines, at the periphery, with the renegades.'*
>
> *Hope and Hope, 1997: 105*

Technology is the common factor, as is IT spending. The notion of outsourcing is highly questionable as a strategic practice. It should be grounded in clear strategic thinking, and not viewed merely as a cost cutting tool. IT, specifically, is generally notorious for its ability as strategic tool – arguably because the IT function generally is outsourced and the return on investment (ROI) is notably high. Hope and Hope [1997] believe that the main reason (high ROI) is that outsourcing is ultimately not about processes and contracts, but about the people function. This will be addressed in Module V on re-engineering and IT.

5. THE IRRESISTIBLE FUTURE OF THE (SELF-) ORGANISATION

Self-organisation offers a solution to the problem of finding a simpler and more effective way to accomplish work. It challenges the most fundamental assumptions about how organisation happens as well as the role of leadership in this. The phenomenon is not new. There are many examples of this – take for instance the repeated incidences of people self-organising after a disaster. People and resources organise and co-ordinate without formal planning. Leaders emerge and recede based on availability and need.

5.1 THE ORGANISATION AS A MACHINE

Despite all the management fads in circulation, the best efforts to create and sustain significant and enduring organisational change still fail. The fact is that organisations exist in a world of constant evolutionary activity. Why then has change become so unnatural in organisations? Wheatley and Kellner-Rogers

[1996] believe that the accumulating failures of organisational change can be traced back to a fundamental but mistaken assumption that organisations are machines. Organisations-as-Machines is a 17th century notion from a time when scientists began to describe the universe as a great clock. Our modern belief in prediction and control originates from these clockwork images. Three hundred years later, the world is still searching for tools, techniques and change levers that will drive change through the organisation, through solutions that people build and re-engineer for peak efficiencies. After all the inventions of modern times, why does the business world still want an organisation to behave like a machine that has no intelligence? Changes in the environment will wreak havoc since machines have no capacity to adapt.

There is a new organisational model emerging that is adaptable, flexible, self-renewing, resilient, able to learn and intelligent – all attributes to be found in living systems. The new tension is that the business world wants organisations to behave like living organisms but wants to treat them as machines. Consequently, it is time to change the way we think about organisations.

5.2 THE ORGANISATION AS A LIVING ENTITY

Organisations consist of the people who work in them, and therefore they are real living systems. All living systems have the capacity to self-organise, to sustain themselves and to move forward toward greater complexity and order as and when needed. They can respond intelligently to the need for change. They organise (and subsequently re-organise) themselves into adaptive patterns and structures without any externally imposed plan or direction. Self-organising systems possess what leadership craves – the ability to respond timeously and continuously to change. In these organisations change is the organising force, not the intruder.

5.3 THREE CONDITIONS OF SELF-ORGANISATIONS

Wheatley and Kellner-Rogers [1996], suggest that, if complex systems can emerge from simple initial conditions, then so can organisations. They base this contention on their thesis in a variety of settings, ranging from world-wide manufacturers, schools and experiments to future battle strategies for the United States Army. From simple conditions, working communities emerge that self organise from local connections into global patterns and processes. Members determine their behaviour firstly on information, on what other members are doing and, secondly, on the collective purpose.

Organisations assume different forms, but generally emerge from fundamentally similar conditions. This organises the *self.* Shared meaning and shared values emerge. Networks of relationships take shape. Information is identified, interpreted and transformed. From these, Wheatley and Kellner-Rogers [1996] identify the following essentials as primary domains for the expression of an organisation – all in terms of information:

- Identity
- information and
- relationships.

These are expanded upon below.

(i) *Identity – The sense-making capacity of an organisation:* All levels of organising begin with some sense or belief that there is a unifying mission. This level of organising occurs around a *self* or identity. This sense of identity subsequently becomes the sense-making process of the organisation. The *self* (identity) of the organisation also includes current interpretations of its history, present decisions and activities and its own sense of the future. Hence, interpretation of data and events are based on the identity of the organisation and its knowledge of what this entails. In this context, biologist, Francisco Varela [Wheatley and Kellner-Rogers, 1996] explains that more than 80% of the information one uses to create perceptions of the world, comes from information already inside one, while less than 20% is external to the brain. This notion explains why organisations sometimes reject reports and data that others believe to be obvious.

This finding by Varela that a system will be disturbed by information based on what goes on inside itself and how it perceives itself at a given time, explains why organisations are never changed by assembling a new set of plans, by implementation directives or by organisational restructurings. He maintains that it is impossible to direct a living system (for instance, an organisation); one may only disturb it.

Identity as a sense-making capacity of the organisation and every organisational effort, needs to be explored and clarified before other decisions can be made. This includes start-up activities such as asking '*Why are we doing this*?' and '*How does this effort connect to our personal sense of purpose and that of the larger system*?' .

Few organising systems start with a commitment to the creation of a coherent sense of identity. Clear alignment around principles and purposes allows for maximum autonomy. This critical partnering of high alignment and high autonomy also appears in IT discussions as design criteria for the creation of effective distributed data processing or client server systems. An enormous amount of organising advantage is lost in the failure to create clear and coherent identity. In a chaotic environment, organisational identity needs to be one of the most stable of endeavours. Even though structures and procedures may change, an organisation's coherent centre could sustain itself, even through turbulence, because it provides clarity on who it is. This possession of clarity leads to expansionary behaviours that may include customers, suppliers and governmental policies.

(ii) *Information – The medium of the organisation:* It is suggested that information lies at the heart of life. According to Wheatley and Kellner-Rogers [1996], Bateson and Beer respectively define information as

' .. a difference which makes a difference'

and

' .. that which changes us.'

Thus, when a system assigns meaning to data (that is, data becomes information), it *in-forms* it [Wheatley and Kellner-Rogers, 1996]. Information which flows openly through an organisation often looks chaotic, but acts as the nutrient of self-organisation. It becomes the *medium* of the organisation, in that:

- No organisation can exist without it.
- The organisation feeds off it.
- It has to be everywhere in the organisation in order to sustain the organisation.

Only when there is sharing of information and it belongs to everyone, can people organise rapidly and effectively around shifts in customers, competitors or the environment. People need access to information that no-one could predict that they may need until they need it. The broad availability of information does not mean that all decisions move to local levels. It provides the organisation with a systems perspective – a notion that more members of the organisation should 'in-form' available data for effective self-organisation to occur. It is information (unplanned, uncontrolled, abundant and superfluous) that creates the conditions for the emergence of fast, well-integrated and effective responses. Complex, living systems thrive on information-processing and the constantly changing edge between stability and chaos (also known as *the edge of chaos* [Wheatley and Kellner-Rogers, 1996]). It is possible for new information to enter, while the system retains its identity. The implosion of IBM and General Motors is evidence of how sophisticated IS and measurement systems can create a sense of internal order while failing to take cognisance of critical new information.

(iii) *Relationships – The pathways of organisation:* Relationships form the pathways to the intelligence of the system. Information is created and transformed through relationships. In self-organised systems, people need access to each other and to be free to reach anywhere in the organisation to accomplish work. To put it even more strongly, in order to act with speed and effectiveness, they need access to the intelligence of the whole system. Where members have access to each other, the system expands to include them as stakeholders. This, in turn, builds relationships, which subsequently, could lead to some of the following positive scenarios:

- Customers engaged in finding a solution, become less insistent on perfection or detailed up-front specifications.
- Colleagues linked by a work project become more tolerant of one another's diverse lives.
- A community invited into a local chemical plant learns how a failure at the plant could create devastation, yet becomes trusting of plant leadership.

5.4 THE DYNAMICS OF THE SELF-ORGANISATION PARADIGM

The domains of identity, information and relationships operate in a dynamic cycle so intertwined that it becomes difficult to distinguish them from each other: New relationships connect more and more of the system, creating information that affects the organisation's identity. Similarly, as information circulates freely it creates new business and propels people into new relationships. As the organisation responds to new information and new relationships, its identity becomes clearer at the same time that it changes [Wheatley and Kellner-Rogers, 1996].

5.4.1 INFORMATION IN THE SELF-ORGANISATION PARADIGM

Most individuals use a combination of information, relationships and identity in order to get their work done: They tend to work with whatever information available, even if it is insufficient and of poor quality. They always work around information, even if they have to create misinformation. They also tend to work with the existing relationships in the system, often going around the system to make critical connections. In executing their work, they refer to the organisational identity as they perceive this. Thus, problems that occur in the organisation are pointers to deeper dynamics occurring in the domains of information, relationships or identity. Generally, the solution is also embedded in these domains. The challenge to leadership therefore lies in the creation of conditions that more effectively support the capacity to self-organise.

5.4.2 CONSEQUENCES OF SELF-ORGANISATION

This new notion of self-organisation makes structures and solutions temporary. Resources and people come together to:

- Create new initiatives.
- Respond to new regulations.
- Shift the organisation's processes.

Leaders emerge at and from the needs of the moment. One surprising consequence of organisational complexity is that few of the sophisticated movements are directed by *specific leadership* [Wheatley and Kellner-Rogers, 1996]. They maintain that there is never any rule about a leader or direction. Rules focus on individual behaviour in relation to other employees. Nature abounds with examples of similar structures. Social insects, bird flocks, fish schools, human traffic jams, all exhibit well-synchronised and highly ordered behaviours which are not directed by any leader, but instead focus around a few rules at the local level. The above notions go against the inherent Western beliefs regarding planning and authority, and will be difficult to implement, bearing in mind the entrenched Western cultures and philosophies. There are fewer levels of management structures. Experimentation is the norm. Local solutions predominate but are kept local and are not elevated to a model for the whole organisation. Involvement and participation constantly deepen. These organisations are experts at the process of change. Employees understand that their organisation is a process of continuous organising.

It is herewith suggested that the notion of self-organisation should lie at the heart of de-engineering the corporation (Module V) which serves as a follow up and a consequence (or clean up) to re-engineering and its failures – in many ways similar to the propositions of thesis and antithesis in philosophy, which combined, form a new synthesis.

5.5 THE WORLDWIDE WEB AS SELF-ORGANISATION

The most potent example of such a self-organised network formed around interests, is that of the Worldwide Web (WWW). It has formed around the availability of information and unbounded access, enabling a new economy to be created, based on the networking of human intelligence.

Until recently, not only was information appliances dumb, they had no intelligence built into them. The introduction of Hypermedia or Hypertext [Tapscott, 1995], allows the user to jump around in a document or between documents rather than creating or reading a document from the beginning. Using the Hypertext Markup Language (HTML) it is possible to select a portion of data available on the WWW and paste this into a document on a work station (together with the links) and send this (in the form of a spreadsheet, for example) to another interested party at another location anywhere in the world. As the WWW grows and more users start linking their information to other information, the web of links grow exponentially – hence the name.

It is also possible to use new software (for example 'Agents'), built into the NET, to conduct intelligent, personalised searches within the WWW. The advantage is that 'Agents' make data networks smarter about people, instead of requiring people to be smart about networks. 'Agents' will also transform the way business is conducted over the Internet as it will perform the searches in terms of what the user wants to buy and determine best price and other important considerations on behalf of the user from stations all over the world.

This self-organisation is not simply about the networking of technology. It does not introduce an age of smart machines, but of humans, who, through intelligent systems, can combine their intelligence, knowledge and creativity to achieve breakthroughs in the creation of wealth and social development.

The emergence of the Information Superhighway has introduced a new revolution as significant as any other in history. A new, intelligent medium of human communications has emerged, in which the computer has expanded from merely being a tool for information management to being the provider of end-to-end business solutions and intelligent communications linked right across the globe. (See Figure 19 and Table 19 in Module IV).

5.6 QVC AS SELF-ORGANISATION

QVC is an on-line shopping network and a worldwide search organisation which purchases goods everywhere in the world. It is a business shaped by IT and the innovations and spread of telecommunications and computers. The next logical step for QVC is the Internet. QVC cannot operate without information and telecommunications technology. It not only relies on existing IT and Telecommunications (ITT), it also depends on emerging technological development, techniques, hardware and new capabilities in equipment and software. As a member of a very large group of businesses that emerged from the ITT revolution and depend heavily on its growth, QVC is the kind of organisation that redesigns itself and regenerates itself as ITT changes. The regeneration is driven by the technological imperative (that is, the technology dimension in organisations). Companies like QVC have no choice but to transform themselves as ITT changes and to incorporate these changes.

5.7 THE HYPERTEXT ORGANISATION

Few existing organisational structures can handle the dynamics and complexities that the new age of knowledge creates. Hierarchical systems are able to handle the acquisition side of knowledge, whilst other structures can handle the creation of new knowledge. This situation calls for a new structure that can handle all facets and aspects of information (current and new) and can assimilate them into the body of knowledge within the organisation. This body of knowledge is embedded in the organisation's vision, its culture and shared values and its technology. This hybrid model will be called the *hypertext organisation* after the notion of hypertext links on the Internet (HTML – Hypertext Mark Up Language and HTTP – Hypertext Transfer Protocol).

While most text is sequential and flat, the hypertext non-sequential medium, allows sections of text to have links to other pieces of text. Pointers are used to reference some text that is also stored within the system. This gives the user the ability to navigate through a variety of material, including different media. Different layers of text are stored separately in separate files and can be pulled onto the screen as needed. Hence it is a possible model for the overall control of multimedia applications. It can be used in its own right, but can also be expanded to become hypermedia.

Within a hypertext organisation, members can traverse through the layers, but can only be in one layer at any given point in time. This ability to switch from one layer to another, is the core feature that distinguishes the hypertext organisation from conventional structures.

5.8 THE QUANTUM ORGANISATION

Within the framework discussed in the Prologue, it is important to also view the business organisation of the future from a quantum perspective. Emerging from the sciences of quantum physics, chaos theory and self-organisation, follows a new and profoundly different view of society and the business world, and one that is far more relevant and immediate to the concerns of managing complexity and change.

Descartes saw the world as a clock-like machine and subsequently built an entire philosophy around this metaphor. The principle tenets of this lifeless and mechanistic world (these being dominance and control, reductionism, determinism and materialism) provided the foundation from which modern social and business institutions evolved. The result was fragmentation and alienation [Youngblood, 1997] – for which re-engineering (Module V) offers some form of solution, even if not complete. It will also be discussed within that module that the principle of re-engineering the processes is not sufficient for quantum leap change. One reason for this is that the traditional business organisation is not designed for change, but rather for stability and the creation of predictable and certain results. Within the stable environment of the previous wave, this proved satisfactory. However, it is almost impossible for these solid and immobile blocks of stone to accept large changes – as would be required through advancing technologies and the re-engineering concept. **Thus, it is hereby proposed that the first re-engineering should not be in terms of the business processes (and subsequently, the business itself – Module V), but in terms of the organisation itself – essentially because it is designed for stability.**

The need for change is constant and unavoidable, thus the fundamental nature and shape of the organisation should be transformed to make future changes easier. The term 'Quantum Organisation' is used to describe organisations where this is the norm. These organisations could typically behave according to the following patterns:

- Employees collectively determine the direction and subsequently empower leadership to point the way.
- Leadership could help (collaborative) teams to realise they are off course and assist in the realignment within the whole.
- Frontline employees would be responsible for the movement of the organisation, not the managers.

Thus, leadership is challenged to assist in the co-ordination of activities and the clarification of the organisation's status and direction and not to carry the burden of responsibility for the whole organisation.

The Quantum Organisation follows as a consequence of the self-organisation, whereby organisations operate on the principles of living systems, are characterised by openness, flexibility, responsiveness, resilience, creativity, vitality, balance and caring [Youngblood, 1997]. Its essence is very much that of the 'chaordic enterprise' described earlier. The organic principles on which Quantum Organisations are based include emphasis on indivisible wholeness, dynamic balance, experimentation, autonomous action in accord with the whole, relationship, purpose and meaning. Subsequent attributes of such an organisation include personal leadership (Senge's 'personal mastery'), flexible network structures, free information flow, interaction between people, sense of purpose, teamwork and partnerships, rational business intelligence and knowledge and balanced short-term and long-term goals. The potential of such an organisation is highlighted by

*'The dynamic connectedness of the web means that web (quantum) organisations reflect organic rather than mechanical principles;
that is they work in the same way that life does.
This naturally makes them more congenial environments for human beings to exist in; more nourishing, more favourable for growth. This congeniality is important, for as we move away from the notion of the organisation as a great machine – rational, static, compartmentalised and closed – we also move away from perhaps the essential aspect of the estrangement of human beings from nature that took root in the industrial Era: the belief that, to be efficient organisations must mimic the design and workings of a machine.'*

Wheatley, 1994: 98

In creating the Quantum Organisation, one should consider alignment between all elements within the organisational ecosystem, these being: culture, structure, technology, process and shared vision and their interconnectivities. Since most of these aspects have already been discussed with regard to Handy's organisational forms and, especially with respect to the 'chaordic enterprise' of which this is a hybrid, further discussion is irrelevant.

6. CONCLUSION

The principle of self-organisation is not new. It corresponds to the informal organisation of the past where people often ignored formal structures, finding them ineffective and unresponsive. A more recent description of the self-organisation is that of 'communities of practice', where the communities are webs of connections woven by people in order to get their work done. People organise together based on their perceived needs and objectives.

Two camps have emerged: Those exhilarated by the emerging trend and those terrified by what this new order might bring.

Drucker [1998] believes that although management grew as a concern from the inside, growth and survival now depend on getting the organisation in touch with the outside world. In this regard, management has become an external task, since results take place outside the organisation. Hence, management does not need more information about what happens inside the organisation. Rather, it needs more information on what happens outside the organisation. He maintains [1989: 176] that:

'When it comes to outside data, we are still very largely in the anecdotal stage. It can be predicted that the main challenge to IT in the next thirty years will be to organise the systematic supply of meaningful outside information.'

He goes on to identify the managed institution as the centre of modern society, rather than productivity or even technology. To achieve this, organisations will have to become multidimensional, in that several organisational structures will be in existence within the same organisation. Individuals will have to learn to work at one and the same time within different structures: For one task, they will work in a team, in another they will work in a command-and-control structure. The same individual who is in a position of command in his or her own organisation, may be a partner in an alliance and even a junior in a joint venture.

' Think of it this way:
The executive of the future will require a toolbox full of organisational structures. He will have to select the right tool for each specific task.'

And this signifies the birth of the chaordic enterprise .. and the antithesis of *de-engineering* the corporation as manifesto to business evolution.

The author believes that this thesis will be incomplete and lacking if it does not also recognise a greater concern and implication, namely that of the important role to play by business organisation in the greater social transformation of society. Reasons are twofold: Business organisations have the funds necessary for such a radical venture, and, secondly, they are the most powerful social force. This will be addressed in the Epilogue.

'An organisation that creates information is nothing but an organisation that allows a maximum of self-organising order or information out of chaos.'

Ikujira Nonaka, 1995: 176

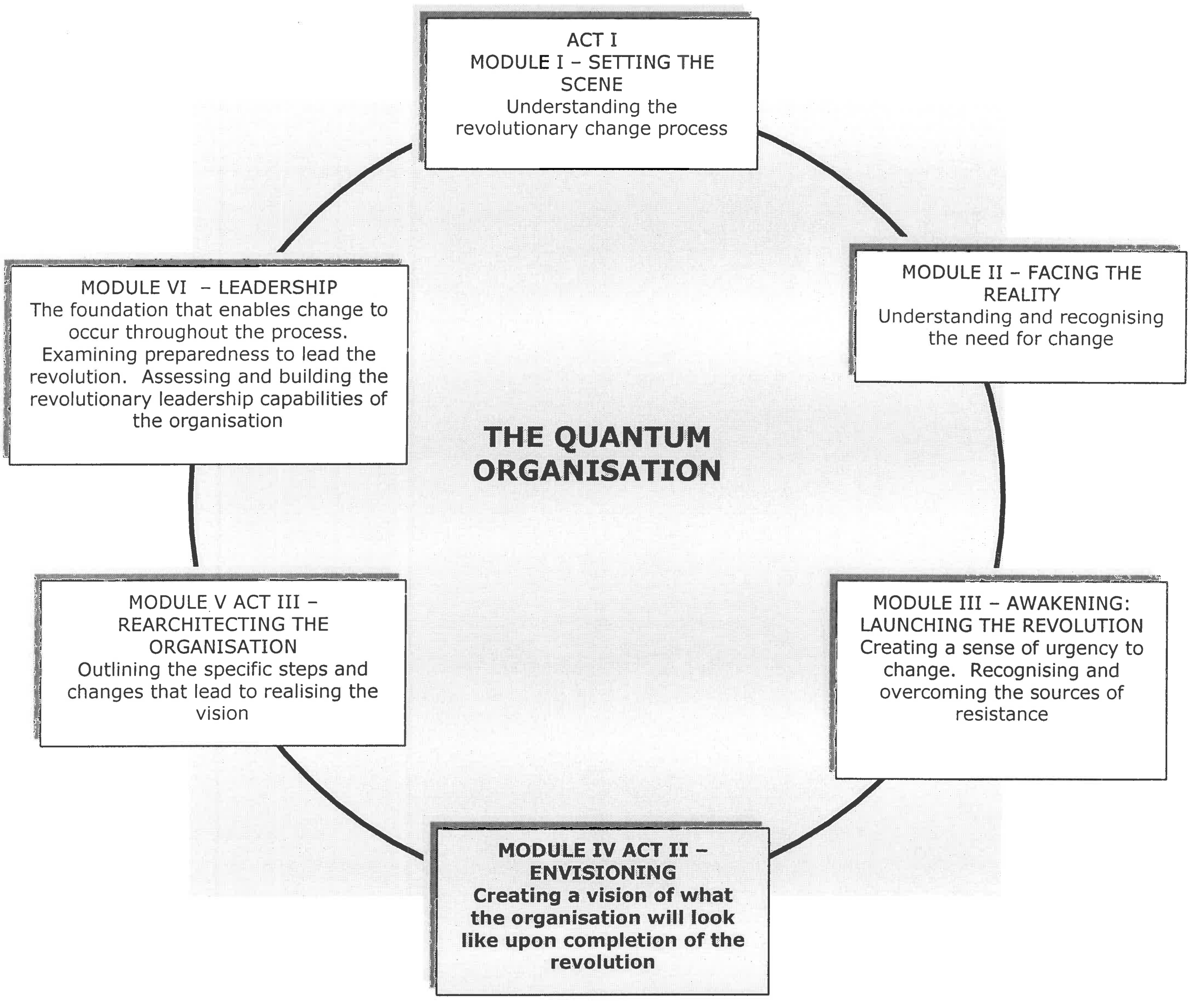
ACT II

CREATING A NEW VISION

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

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

Plato: xxii



MODULE OBJECTIVES

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

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

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

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

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

1. INTRODUCTION

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

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

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

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

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

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

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

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

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

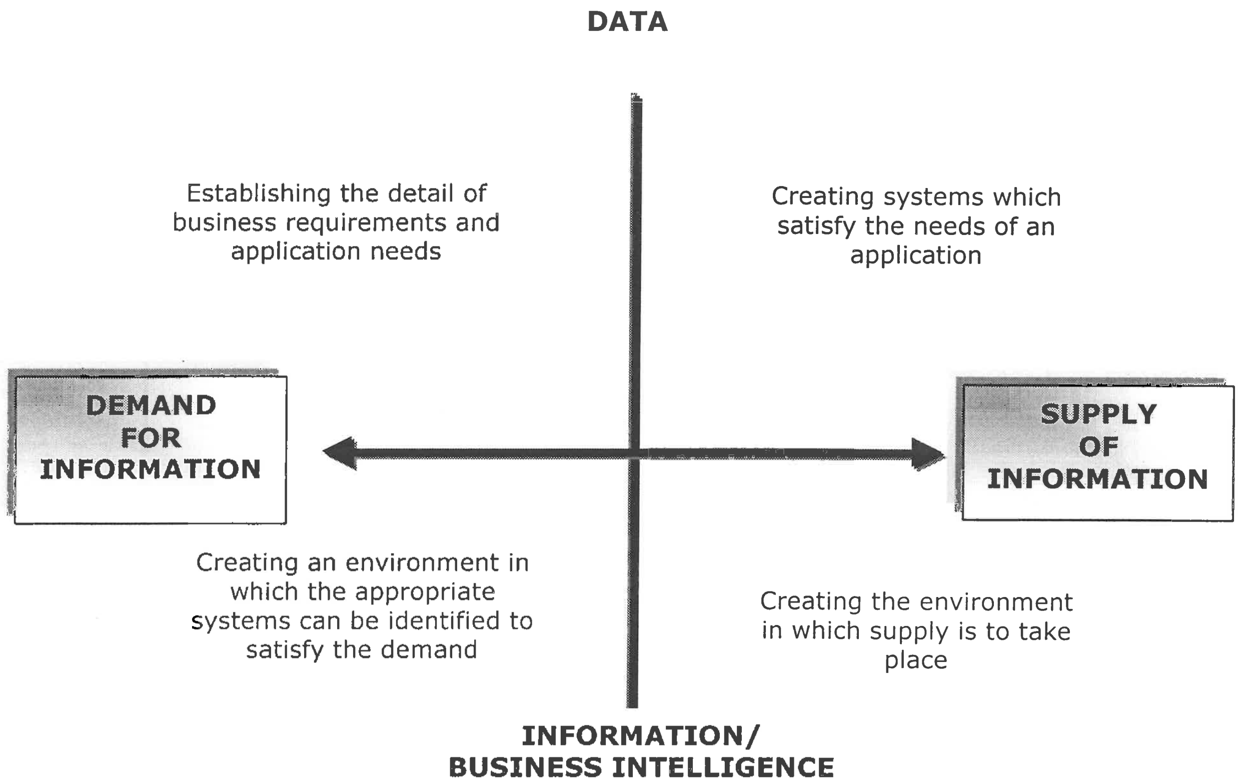


Figure 11: The proposed link (and difference) between the systems and technology sides of information

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

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

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

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

These are:

- Time,
- content and
- form.

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

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

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

(iii) *The form dimension of information:* This dimension deals with the *how* aspect of information and includes detail (or information granularity or resolution) and presentation (graphically, video or special technology).

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

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

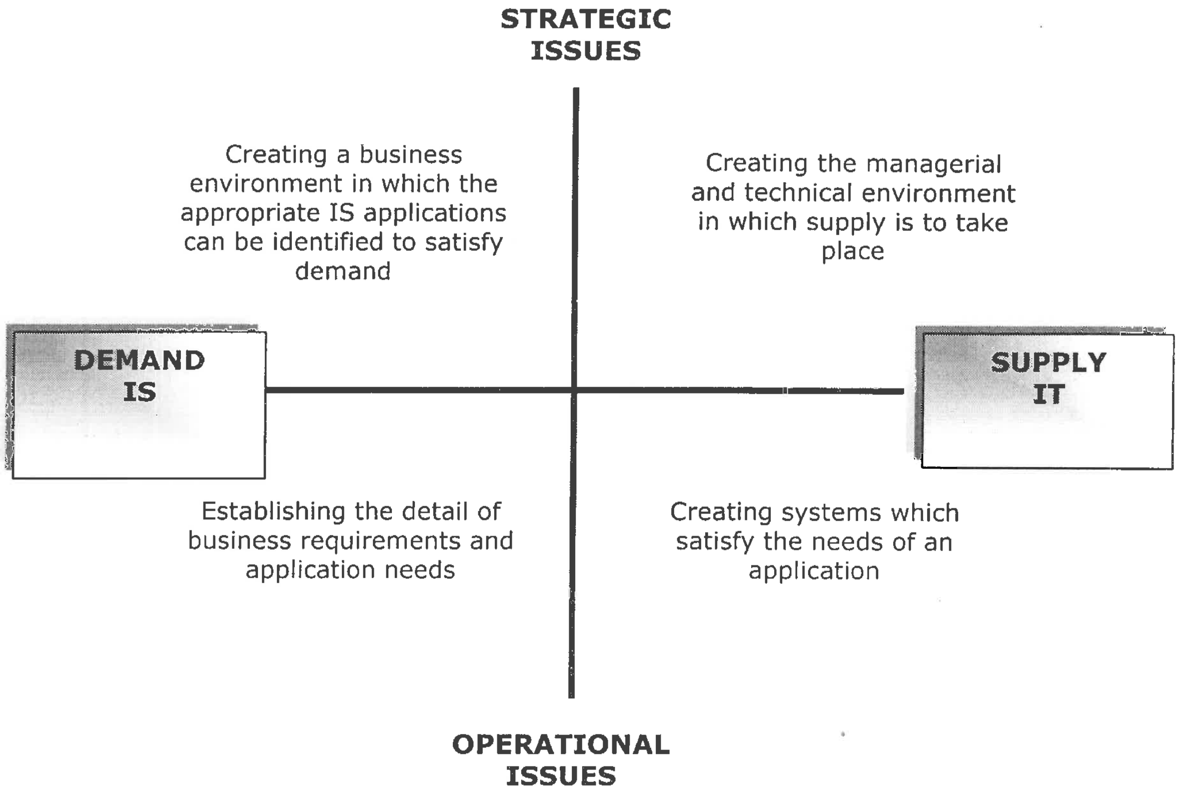


Figure 12: Differentiation between strategic and operational information issues
After Edwards, Ward and Bytheway, 1995

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

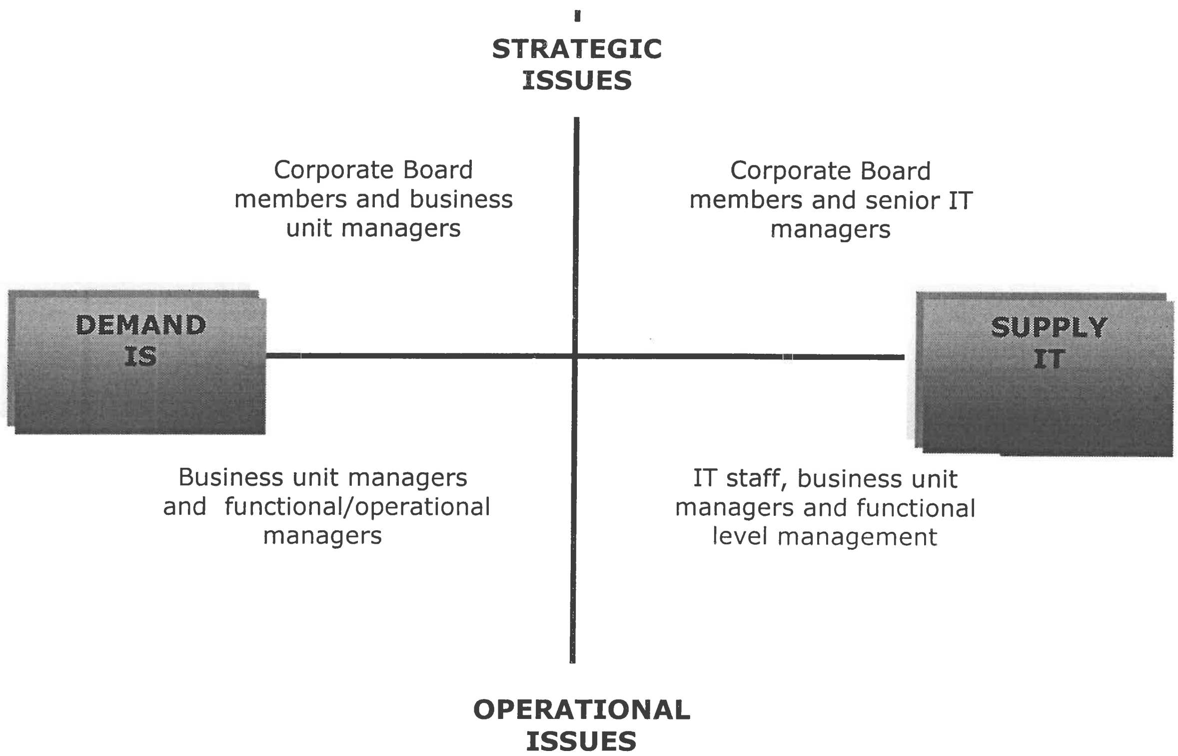


Figure 13: Different roles pertaining to the two sides to information
After Edwards, Ward and Bytheway

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

1.1 THE NEW AGE OF THE BUSINESS INTELLIGENCE ECONOMY

The study of human knowledge is as old as human history itself. It has been the central subject matter of philosophy and epistemology since the period of the Greek philosophers. Drucker and Toffler are two business theorists who call attention to the importance of knowledge as a business resource and a source of power. Using knowledge as the new competitive advantage calls for a fundamental shift in thinking about the business organisation. The focus is not only on the *process* of knowledge, but also on *creation* of that knowledge.

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

Thus, knowledge creation takes place at three distinct levels:

- Individual,
- group and
- organisation.

[After: Nonaka and Takeuchi, 1995]

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

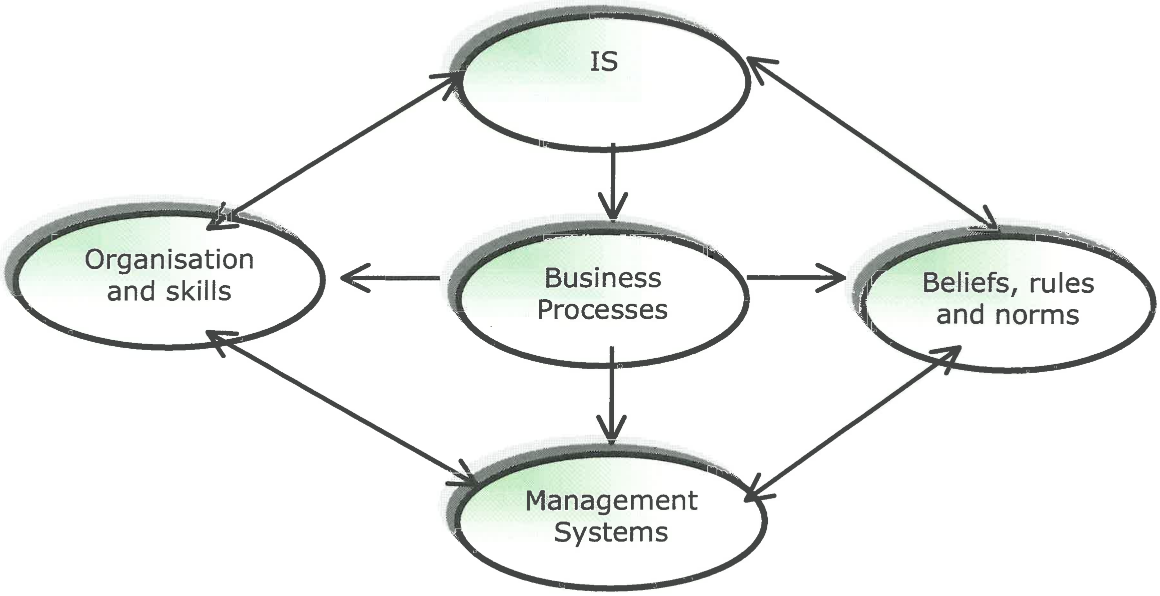


Figure 14: The Re-engineering diamond as framework for the relationship between the information and the business systems
Source: CSC Foundation, 1996: 3

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

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

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

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

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

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

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

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

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

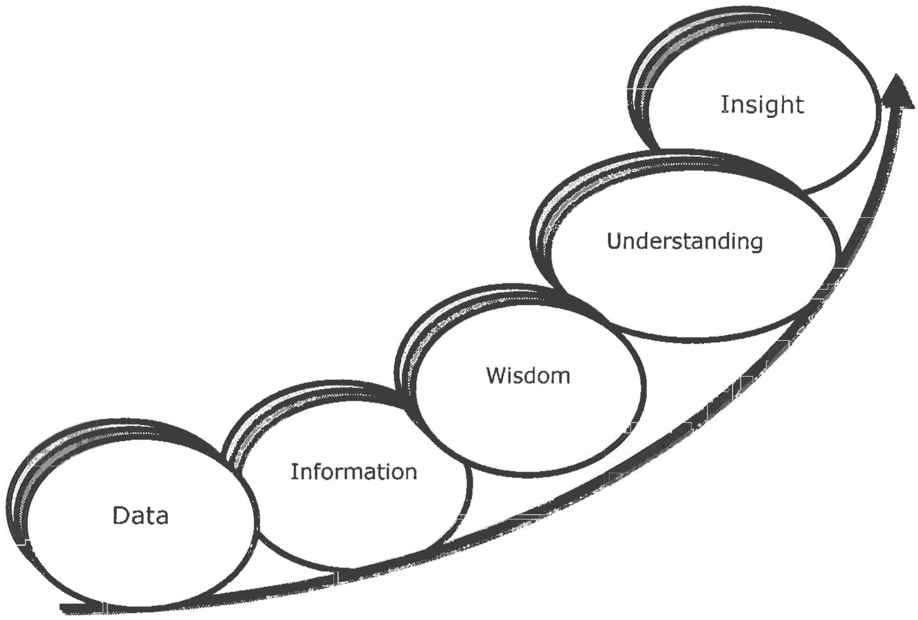


Figure 15: Knowledge levels for decision-making
After Laudon and Laudon, 1997

These notions are defined in the table below:

Table 9: Definition of terms

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

After: Laudon and Laudon, 1997

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

Table 10: Modes of inquiry

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

After: Laudon and Laudon, 1997

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

Business data → Business information/knowledge → Business intelligence,

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

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

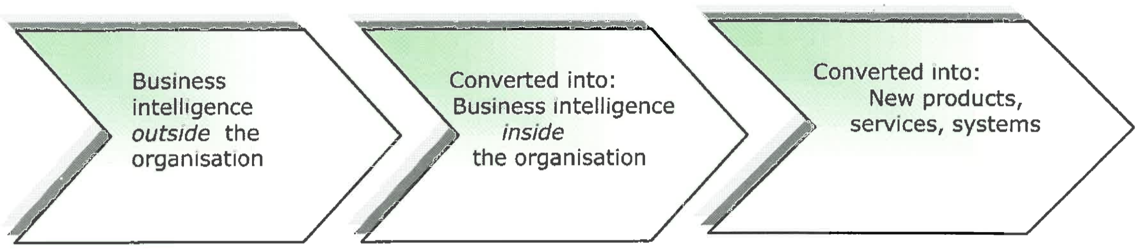


Figure 16: The transformation process of business intelligence

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

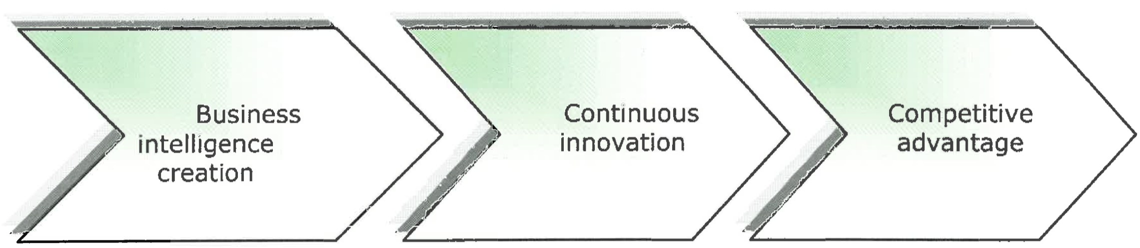


Figure 17: Competitive advantage gained from business intelligence

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

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

Laudon and Laudon, 1997,

whereas Mallach [1994: 679] notes

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

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

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

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

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

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

Source: Mallach, 1995

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

Table 12: Different IS purporting to different organisational levels

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

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

2. THE NEW TECHNOLOGY – A REVOLUTION

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

Douglas Englebart, 1962

Almost forty years later, the (almost) revolution (not evolution) in technology substantiates Englebart's vision. He was arguably the first person to look beyond the existing paradigm of data processing at that time to an envisaged new paradigm in technology. He (Englebart [1962]) subsequently conducted a Knowledge Workshop. Knowledge workers were directly supported by networked workstations providing sophisticated communications, information handling and decision support tools. The system contained a number of inventions. Users manipulated a gimmick called a 'mouse' for cursor control; they went beyond data processing using an invention called 'word processing'; electronic documents were contained (and were linked) through a complete structure called 'hypertext' (the basis of today's Internet); and users were on-line and could communicate with one another through something called 'electronic mail'. Most importantly, the system was not used by so-called operators, but by knowledge workers and the system was not designed to automate but as a communications system to support employees [Englebart, 1962].

2.1 THE EVOLUTION OF IT

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

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

According to Senn [1998: 12],

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

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

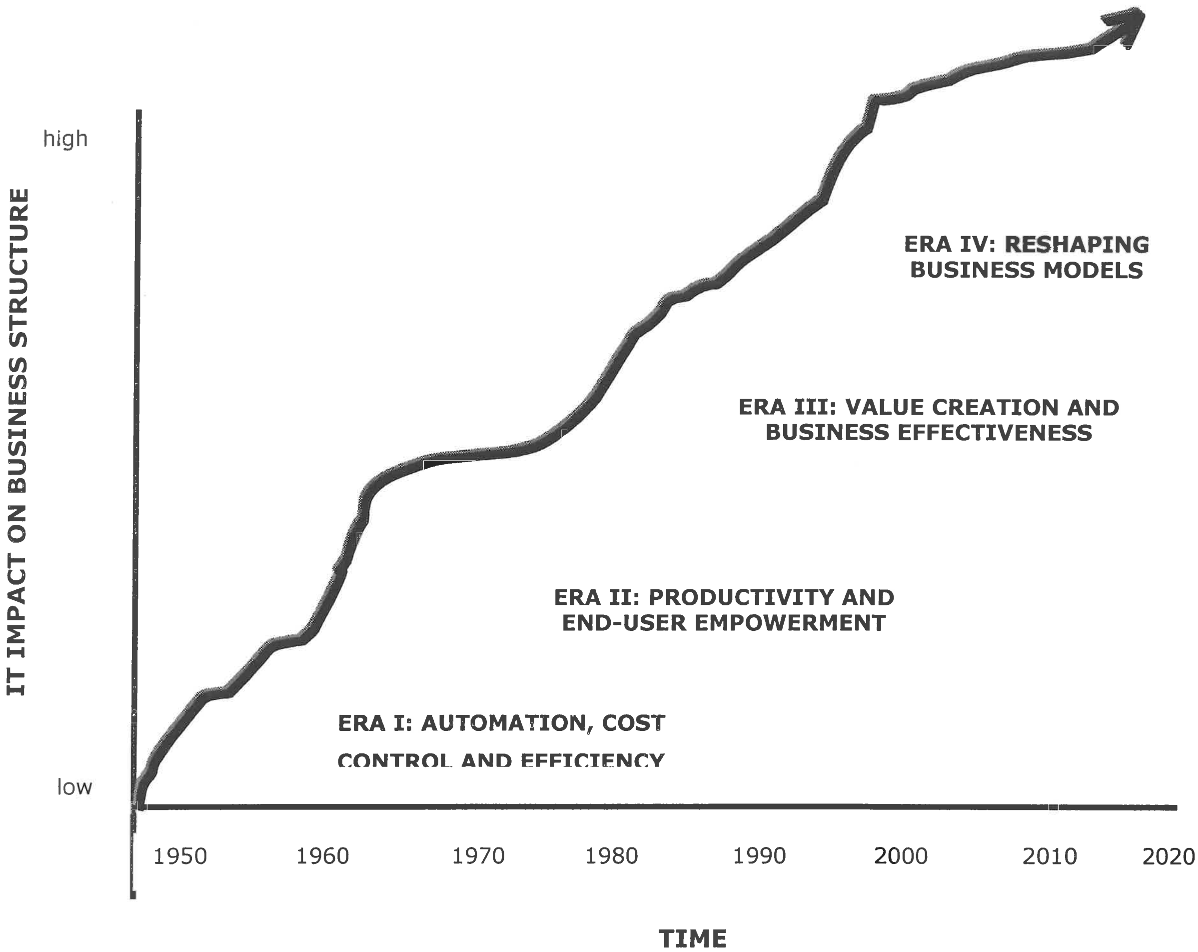


Figure 18: The evolution of IT in terms of investment drivers, technology cycles and change
After: Gartner, 1999

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

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

Table 13: Application framework for IT, highlighting its evolution

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

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

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

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

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

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

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

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

2.2 TECHNOLOGICAL FORECASTING

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

Drucker, 1970

According to Drucker's beliefs as stated above, all that is certain about the future is that it will be different from the present or the past. Since technology is responsible for many of the most important changes in society, forecasting future advances in technology, as well as their impact, will have a significant effect on the organisational strategy. The planning horizons for organisations are becoming much shorter [Burgelman and Maidique, 1988] and in this regard, it is important to note the evolution of IT (Module II) and emerging trends.

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

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

Table 15: Technology shifts for competitive advantage

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

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

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

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

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

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

2.3 TECHNOLOGY INNOVATION

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

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

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

These are expanded upon below.

(i) *Relationship to business strategy:* This entails identification of the roles for enabling technologies in the business strategy, especially since advanced technologies are key spurs for BPR projects, and the advancement of technologies may address the pursuit of business value in the chosen value discipline. (Refer to Figure 9.)

(ii) *Pace of technology innovation:* This is concerned with the urgency and adaptability issues of the technology infrastructure.

(iii) *Roles in the technology innovation process:* Issues revolve around the organisational commitment to technological innovation and collaboration between leadership and IT managers.

(iv) *Funding of technology innovation:* This pertains to the percentage of the budget allocated to technology innovation and shows the level of commitment in this regard.

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

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

2.4 THE COSTS OF IMPLEMENTING IT

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

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

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

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

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

2.4.1 A TCO PERSPECTIVE

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

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

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

- Acquisition,
- possession and
- sustenance.

The above will be expanded upon below.

(i) *Costs pertaining to the acquisition of the product or system:* These refer to all costs concerned with ensuring the conformance of the product.

(ii) *Costs pertaining to the possession of the product or system:* These refer to all reactive costs that ensure that the conformance and compatibility will be adhered to in the future.

(iii) *Costs pertaining to the sustenance of the product.* These costs refer to the implementation and running of the system.

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

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

These are:

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

These are explored below.

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

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

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

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

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

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

Table 16: Suggested implementation model for TCO

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

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

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

2.4.2 AN ROIT PERSPECTIVE

According to a survey conducted in January 1998 by Bartholomew [Violino, 1998], 50% of executives surveyed use some form of return on investment (ROI) metric for their IT projects, whereas a similar survey one year previously indicated that only 20% of the respondents used a formal ROI measurement. On the other hand, some executives mentioned doing 'what if' scenarios because the competition did so [Davids, 1998]. The issue is further compounded by leadership's lack of understanding of the new IT capabilities and the fact that

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

Steven Sprinkle, Deloitte and Touche, 1998

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

He attributes this to:

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

Sweat [1998] maintains that the problem in calculating the ROI of IT is that IT is inextricably linked to all facets of the business, making it difficult to separate the ROIT investment from that of other investments. According to him, IT managers often find traditional accounting methods (which look at the cost of an investment relative to revenue generated) meaningless. The reason for this lies in the fact that IT benefits are not always quantifiable in the traditional sense – mainly because IT investments may have long-term implications. This is corroborated by a study done by Wen, Yen and Lin [1998] in which they propose that the investment payoff on IT is difficult because most of IT's benefits are qualitative, indirect, diffuse and long-term. The actual measurement of the IT investment payoff should incorporate tangible and intangible benefit factors. The concomitant risk factors should be identified and evaluated. (The different information delivery systems engendering these different tangible and intangible risk factors will be discussed in Section 3.3.)

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

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

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

3. PROPOSED CLASSIFICATION OF INFORMATION TECHNOLOGIES

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

- Technological costs
- system costs and
- support costs.

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

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

3.1 CLASSIFICATION OF INFORMATION DELIVERY SYSTEMS

It is evident that IT has given organisations competitive parity. The history of IT has essentially been that of finding more efficient ways and means of getting data into systems to perform simple tasks (see Figure 18). Greater efficiency results in less waste, fewer resources and reduced costs. Also, by standardising and integrating systems, more waste is eliminated. One possible disadvantage of this approach is that organisations all perform at the same level. Thus, standard approaches to IT may deliver short-term competitive advantages, but, in the long-term, may only ensure competitive parity. Moreover, standard approaches to IT may corrode differentiating strengths. In view of this, organisations should find ways to discover, develop and accentuate their strengths. The focus of future organisations will not be on collecting data, but rather on acquiring information (and business intelligence) to support and enhance innovation. Competitive advantage comes from matching internal strengths to profitable opportunities to create and sustain advantages that competitors cannot easily copy. For this, they need information about their own businesses, their customers and the external environment. The data that organisations collect over many years could act as the source of that information. This is the notion of 'information delivery'.

3.2 DEFINITION OF INFORMATION DELIVERY

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

These are:

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

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

3.3 CLASSIFICATION OF INFORMATION DELIVERY SYSTEMS

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

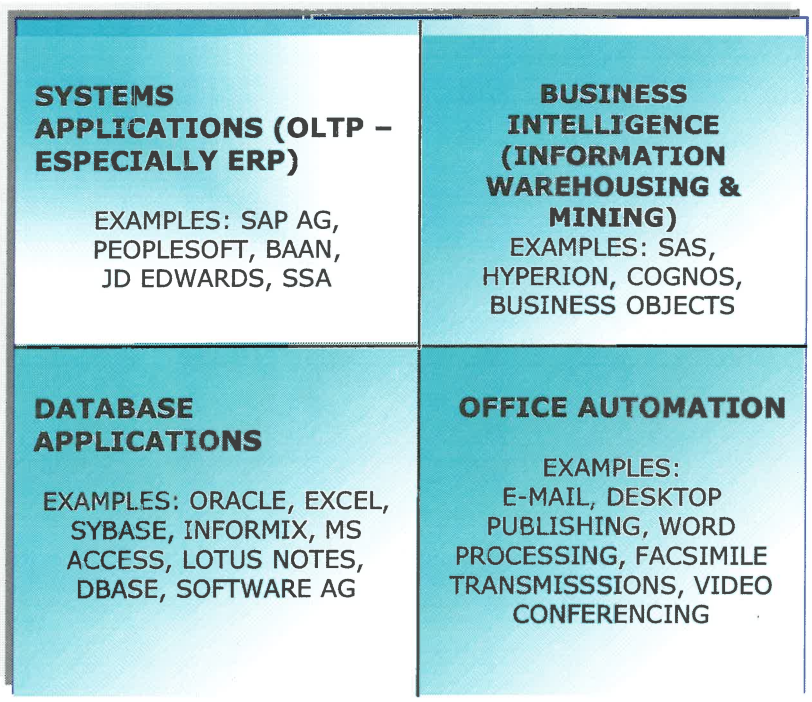


Figure 19: Proposed classification of information delivery systems in terms of cost and ease of implementation

Each quadrant of the software industry has a clear leader – MICROSOFT (personal productivity), ORACLE (transactional databases), SAP (standard transactional applications) and SAS (business intelligence). The most relevant of these will be discussed next, using the market leader in that quadrant as an example. It should be noted, however, that there is evidence that the products in the different quadrants of the matrix, are continuously improving and competing with those in other quadrants. The first and most basic level is that of office automation and, since it is felt that most organisations have already invested in these systems, they will not be discussed in this thesis. The other three quadrants will be discussed in the order in which this author believes them becoming pertinent to organisations and their growing need for strategic information (or business intelligence). Thus, it is this author's contention that organisations will move through these quadrants in the following order as a subsequent need for (strategic) information arises and corresponding to the evolution of IT in Figure 18:

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

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

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

They add:

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

Consequently, a single DB services multiple applications.

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

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

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

A multidimensional DB model represents relationships between data in a multidimensional structure. This principle is best viewed as cubes of data and cubes within cubes of data, with every side of the cube consisting of another level of information, in contrast to spreadsheet applications which consist of data of a flat nature. Thus a matrix of actual sales can be stacked on top of a matrix of projected sales to form a cube with six faces. Cubes may be nested within cubes to build complex views of data. The DB environment is schematically presented below with the DBMS acting as an interface between the application programmes and the data.

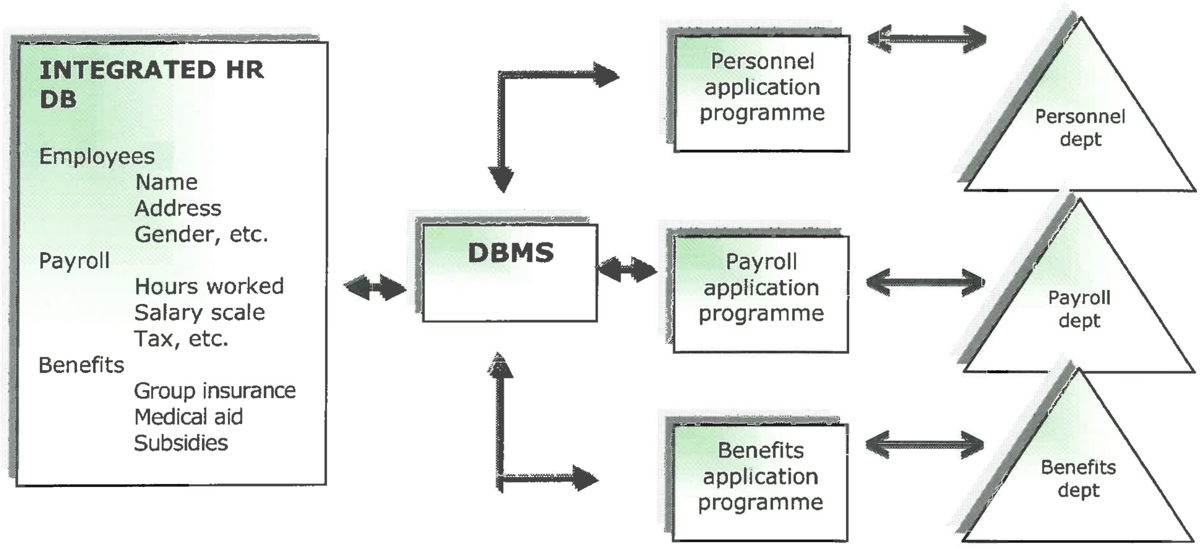


Figure 20: The DB environment
After: Laudon and Laudon, 1997

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

Table 17: Main advantages of DBMS

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

After: Haag, Cummings and Dawkins, 1998

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

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

Table 18: Organisational issues in the implementation of ERP systems

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

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

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

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

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

Table 19: Different platforms for operational data and information warehousing

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

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

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

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

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

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

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

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

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

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

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

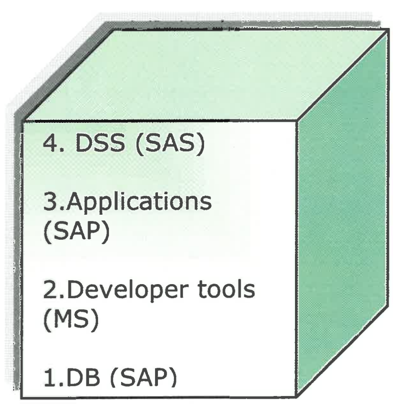


Figure 21: ORACLE's stacked system as example of trends towards business intelligence

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

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

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

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

4.1 DEFINITION OF DIGITAL COMMERCE

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

> *'Electronic commerce is a methodology that addresses the use of IT as an enabler of business. Electronic business supports both internal and external business functions.*
> *That is, external electronic commerce addresses the use of IT to support how a business interacts with the marketplace, and internal electronic commerce addresses the use of IT to support the internal processes, functions and operations.'*

This definition encompasses two related IT themes. These are:

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

In business, digital commerce includes:

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

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

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

4.2 APPLICATION OF DIGITAL COMMERCE

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

The application of digital commerce has the following advantages:

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

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

5. CRAFTING AND CREATING COMPETITIVE ADVANTAGE THROUGH IT

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

The main models are:

- The Strategic Grid and
- the Strategic Alignment Model.

5.1 THE STRATEGIC GRID

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

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

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

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

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

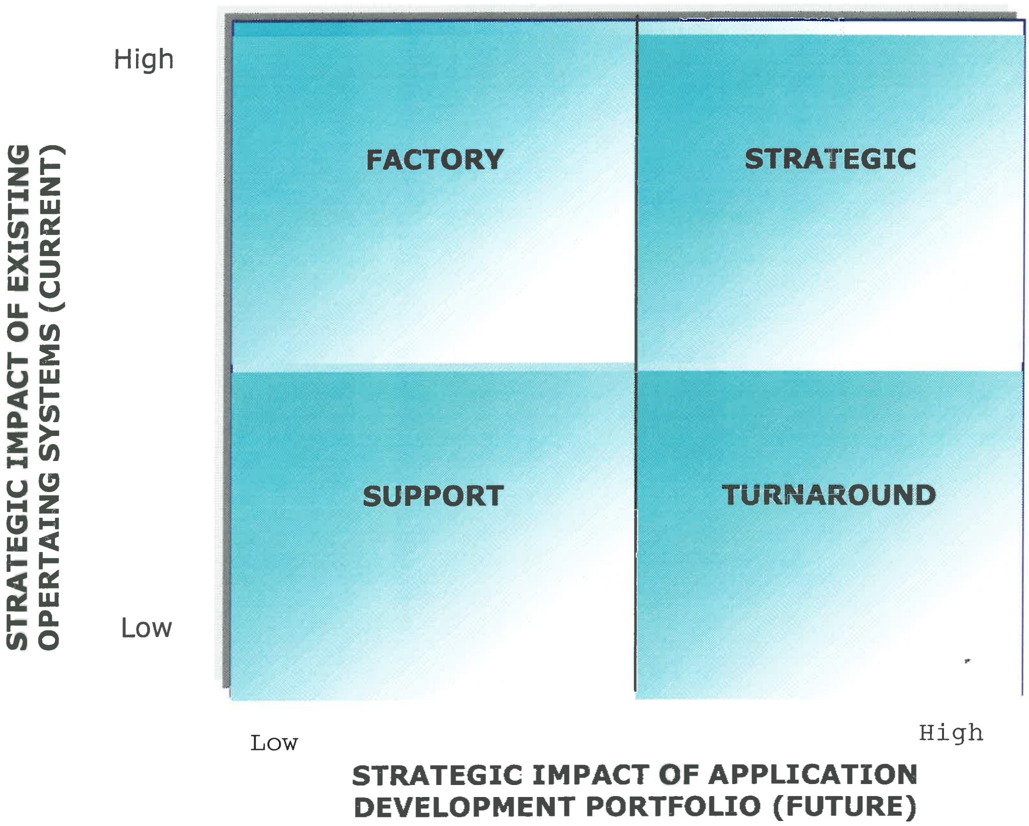


Figure 22: (IT) Strategic Grid Model
Source: Revenaugh, 1994

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

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

(ii) *Turnaround quadrant:* Organisations in this quadrant are not critically dependent upon IS applications for their current operations, but applications under development, are expected to play a vital role in the organisation's future. As is the case with organisations in the strategic quadrant, turnaround organisations should have significant top management involvement in their planning process. Since turnaround organisations are not used to this type of involvement, other changes should occur to enhance senior management's understanding and overview of IS.

(iii) *Factory cell:* Organisations in the factory cell are critically dependent upon existing IT support systems. However, applications under development are not crucial to the organisation's ability to compete successfully. Strategic IS planning and linkage to long-term corporate plans are not nearly as critical in this environment. IS planning should continue to take place with guidance as to where the organisation is going, but, senior management involvement in the planning process is commensurately far less.

(iv) *Support cell organisations*: These organisations are in the low quadrant of the grid, suggesting that they would place the minimum emphasis on IS and IS planning in terms of top management concern and involvement.

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

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

5.2 THE STRATEGIC ALIGNMENT MODEL

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

However, the following are real areas for concern:

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

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

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

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

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

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

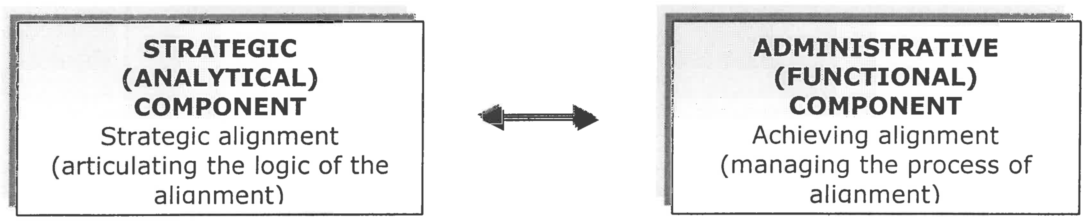


Figure 23: The two components of continuous strategic alignment
Henderson and Venkatraman, 1993: 140

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

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

The Strategic Alignment Model is shown in Figure 24 below and summarises four dominant alignment perspectives – each representing a triangle of three concepts covering both business and IT domains, as well as internal and external domains. Each perspective is unique in terms of the driving force (business or IT strategy) and represents distinct and mutually exclusive management implications.

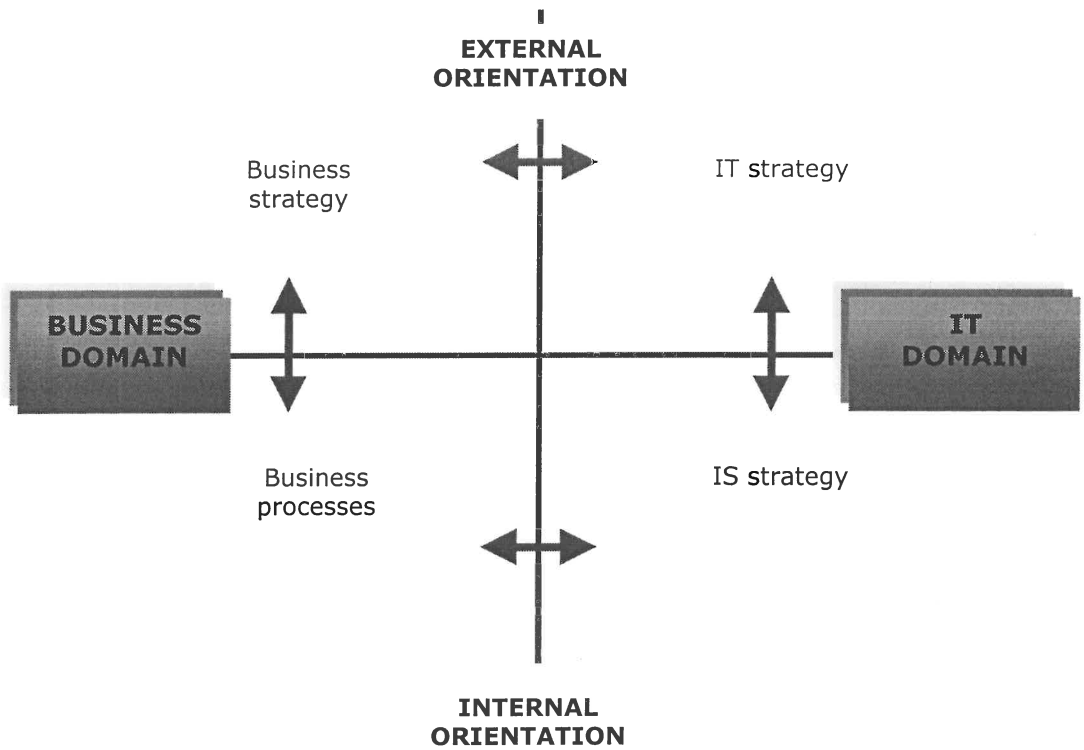


Figure 24: The Strategic Alignment Model
Source: Henderson and Venkatraman, 1993

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

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

Then, according to Henderson and Venkatraman [1993], the link between business strategy and IT strategy reflects the capability to use IT strategy as a lever to both shape and support business strategy. Correspondingly, the link between organisational infrastructure and processes, and IT infrastructure and processes, reflects the need to ensure internal coherence between the organisational requirements and expectations and the delivery capability within the IS function.

These perspectives are expanded upon below.

Perspective 1 - Strategy execution:

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

Perspective 2 - Technological potential:

This alignment perspective involves the articulation of IT strategy to support the chosen business strategy and the corresponding specification of the required IS infrastructure and processes. In contrast to the strategy execution logic, this perspective is not constrained by current organisational design. Rather, it seeks to identify the best possible IT competencies through appropriate positioning in the IT market environment, as well as the identification of the corresponding IS architecture. For this alignment to succeed, top management should provide the technology vision to articulate the logic and choices pertaining to IT strategy that would best support the chosen business strategy, with the role of the IS manager being that of technology architect – who efficiently and effectively designs and implements the required IS infrastructure that is consistent with the external component of IT strategy (scope, competencies and governance). The performance criterion is based upon technology leadership with qualitative but insightful benchmarking along a set path of critical measures pertaining to the positioning in the IT marketplace.

Perspective 3 - Competitive potential:

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

Perspective 4 - Service level:

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

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

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

These are summarised in the scheme below.

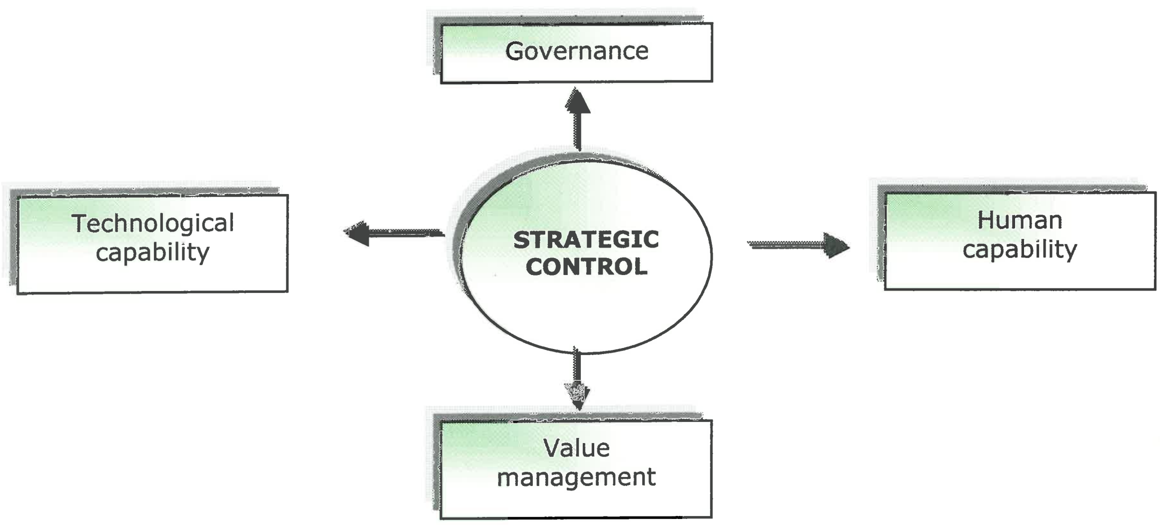


Figure 25: Summary of the four administrative functions needed to support the IT alignment strategy
After: Venkatraman, Henderson and Oldach, 1993

Following on earlier discussions in this module, and since the effect of and the evaluation of the IT investment will be studied in the next Module, the above issue of value management needs attention. According to Venkatraman, Henderson and Oldach [1993], value management comprises of three interrelated activities.

These are:

- Investment decisions,
- performance management and
- evaluation.

These will be expanded upon below.

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

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

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

(ii) *Performance measurement:* Deals with the design of a measurement system that will be used to guide the operational activities with the emphasis on the logic of the design. Within the application of Total Quality Management (TQM), the involvement of leadership is critical in the design of an appropriate measurement to ensure that the IT investment achieves the desired benefits.

(iii) *Evaluation:* This is deemed different from the traditional technological audit, in the sense that evaluation should be considered from the initiation phase of any project to maximise potential benefits and organisational learning.

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

6. CONCLUSION

Until recently, organisations have had to balance the cost of sending data (or information) by tailoring the amount, timeliness, speed and interactivity of the information exchange to economic realities. A fundamental shift in the cost of information and of information delivery is removing the trade-off between audience size and richness of information. New ways of communicating (information) are making it economical and easier to send high volume, quick, multimedia, customised and interactive information across the globe. This fundamental shift in information economics will cause two changes in organisations:

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

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

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

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

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

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

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

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

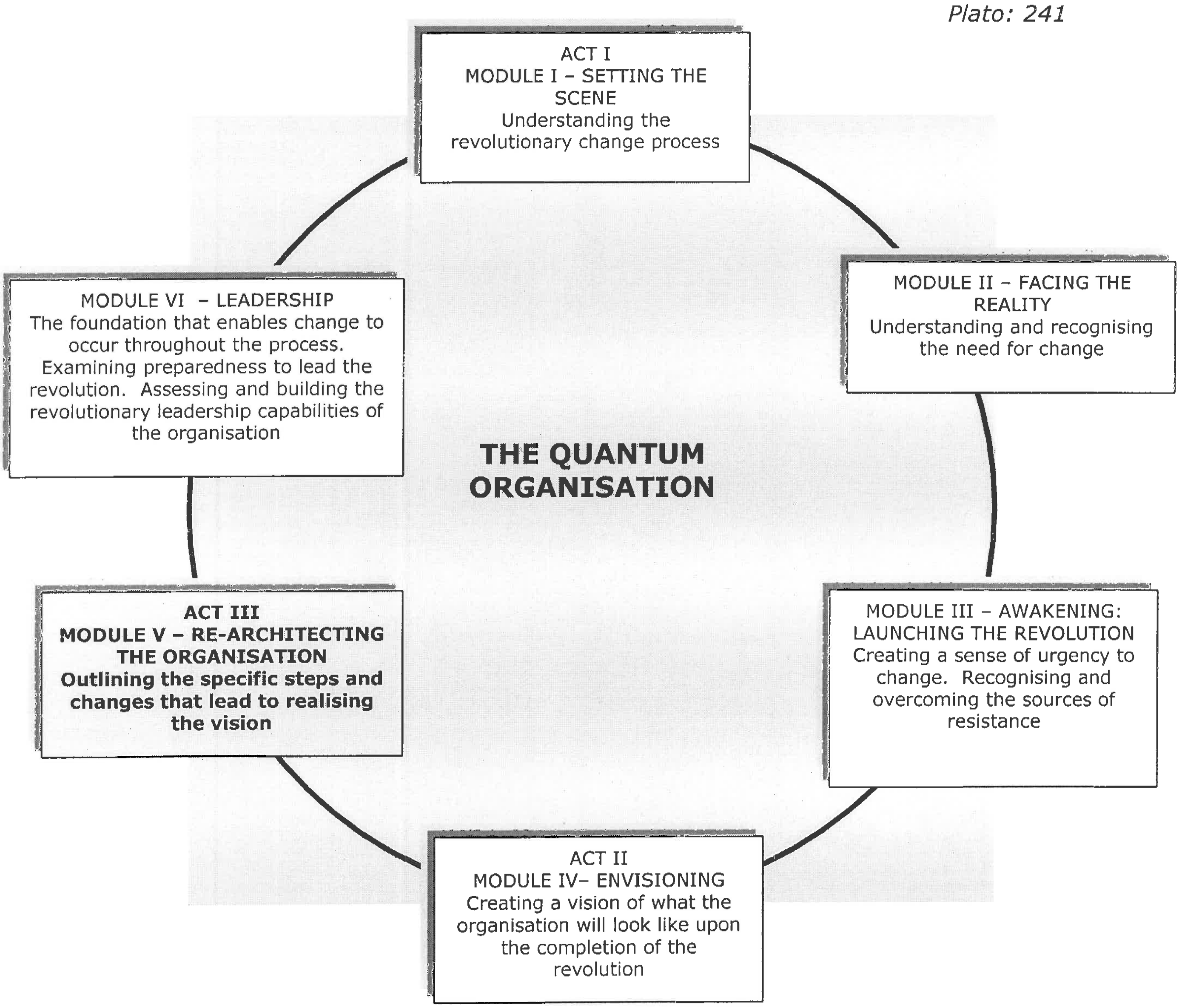
ACT III

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.

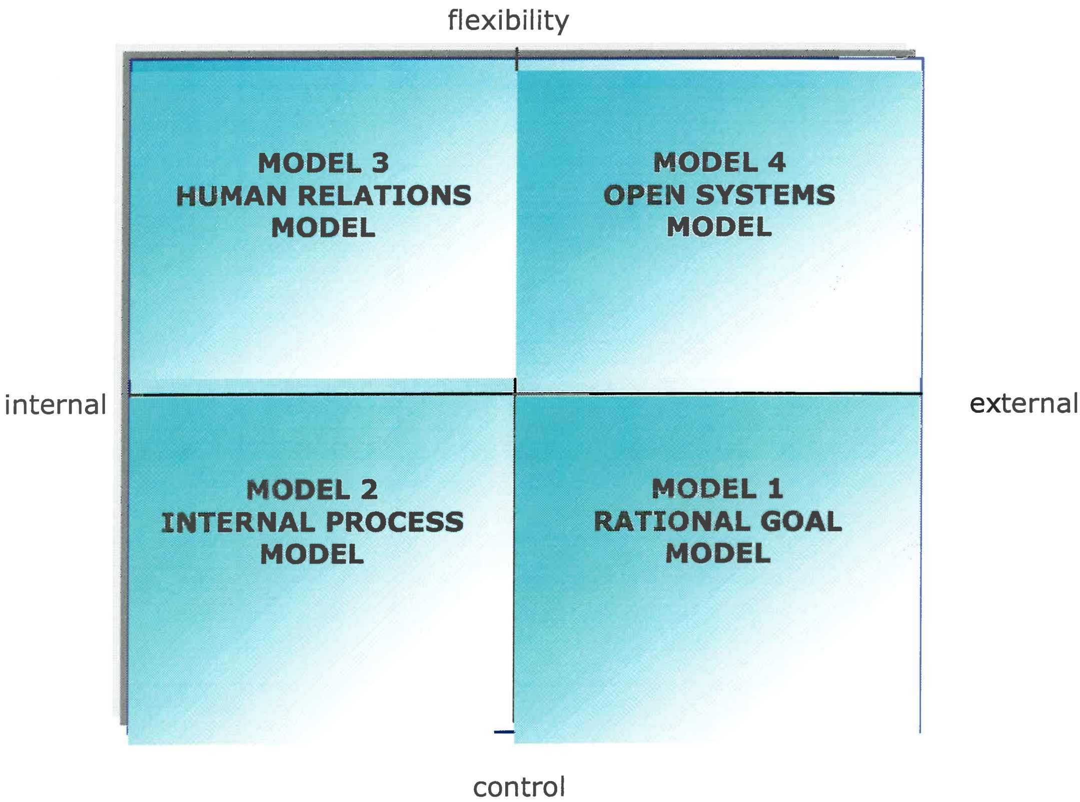


Figure 26: Integration of the four models into one Competing Values Framework
Source: Quinn ***et al.,*** *1993: 12*

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.

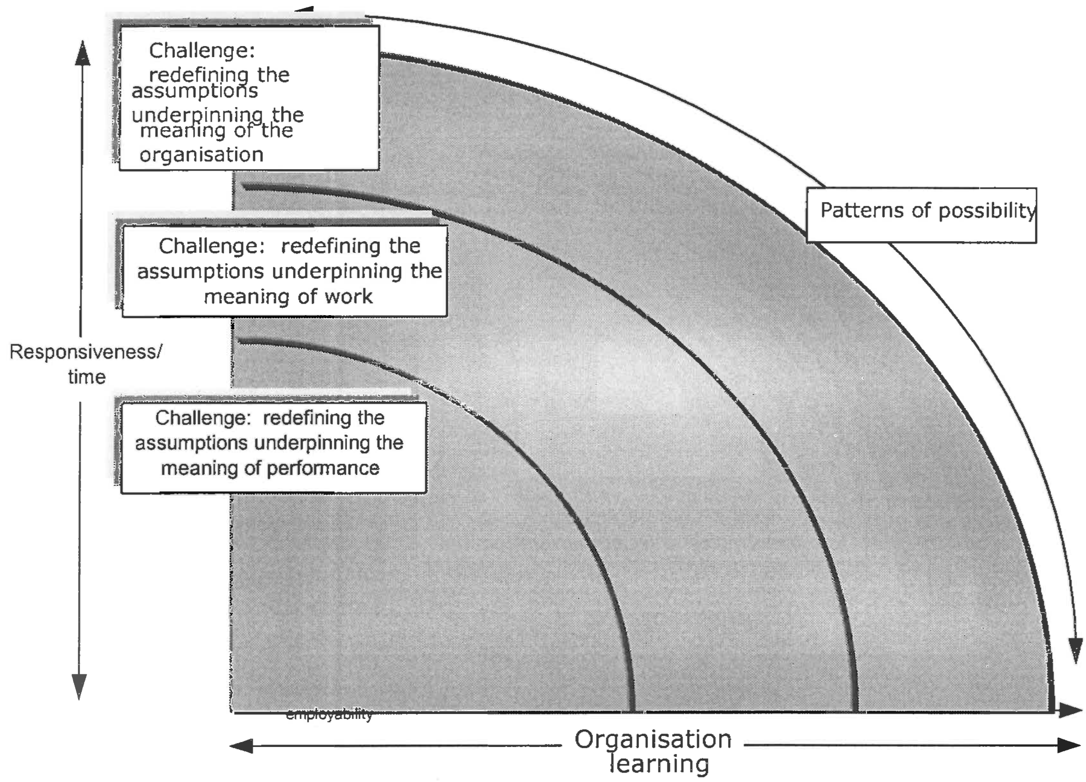


Figure 27: The learning organisation as a journey
Source: Burdett, 1994: 36

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.

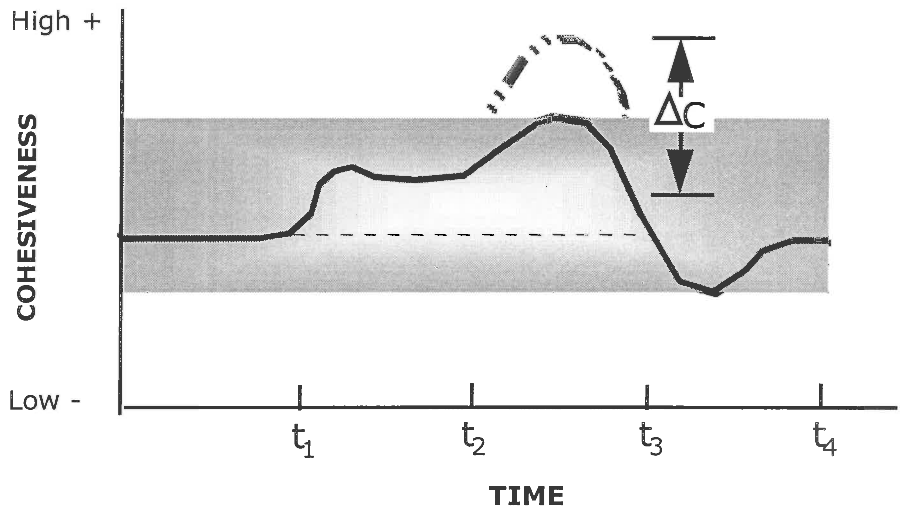


Figure 28: Organisational cohesiveness function
Source: Kimberly and Quinn, 1984: 180

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.

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[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.

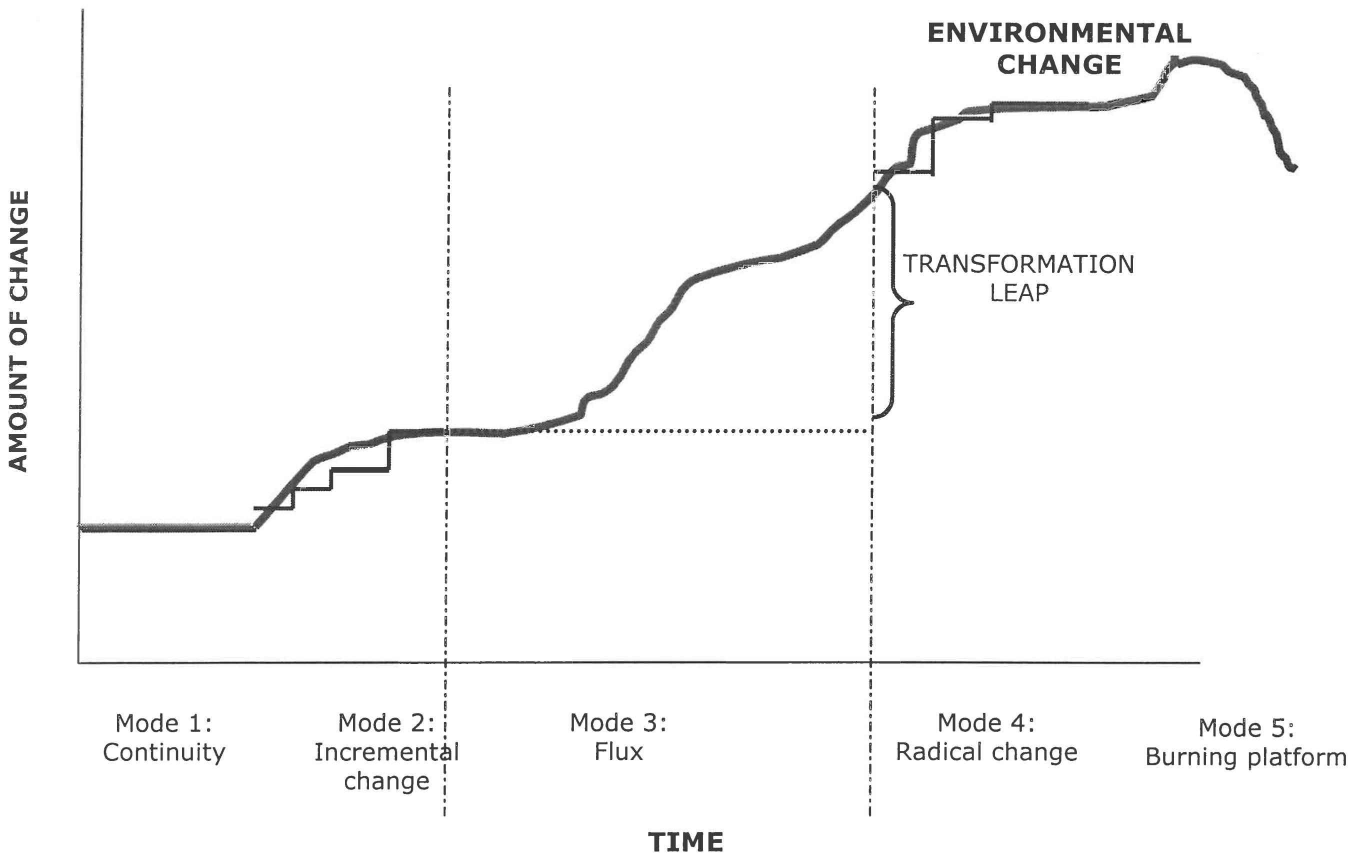


Figure 29: The nature of strategic change
After: Schultheis and Sumner, 1992

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).

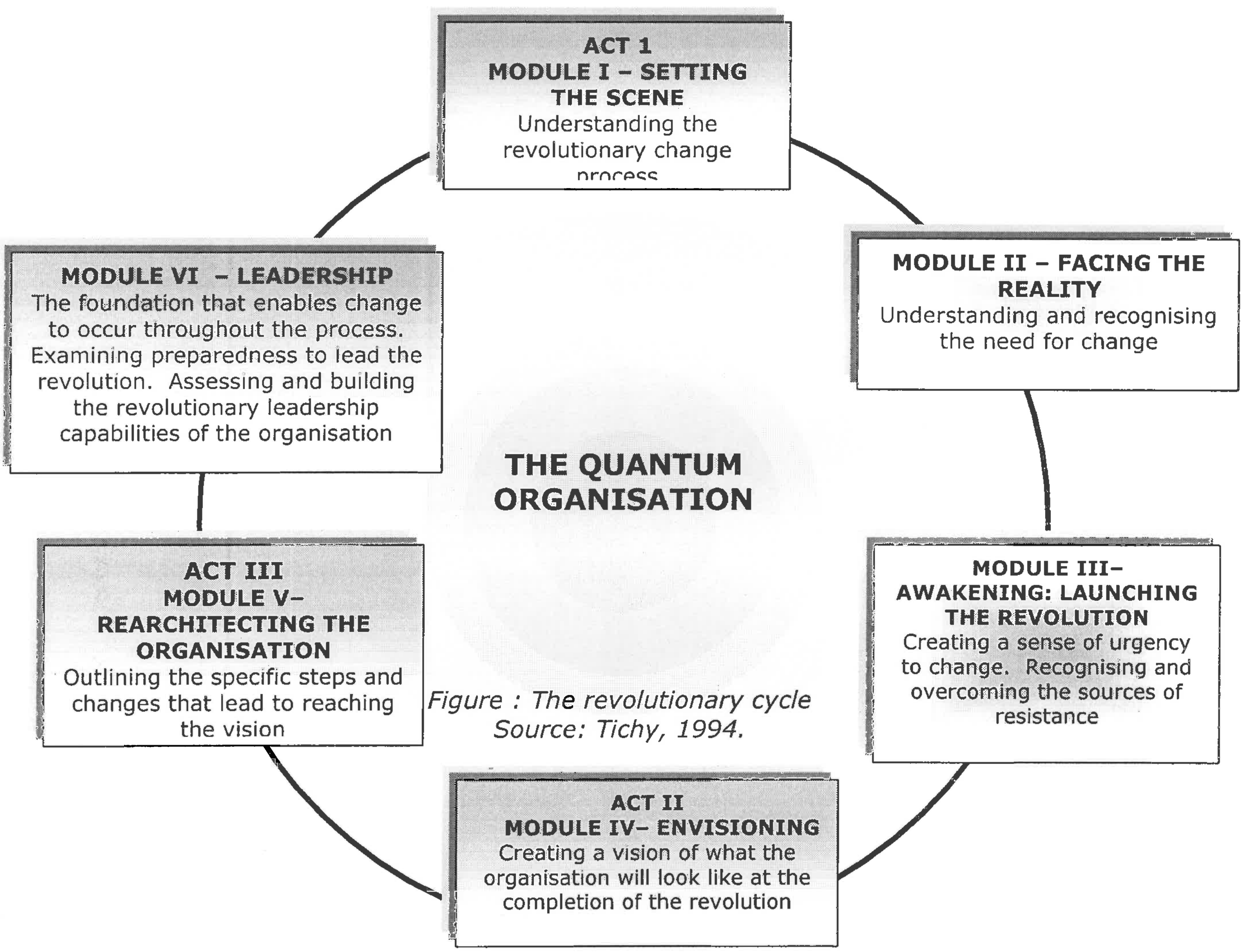


Figure 30: Tichy's revolutionary model for organisational change
Source: Tichy, 1993

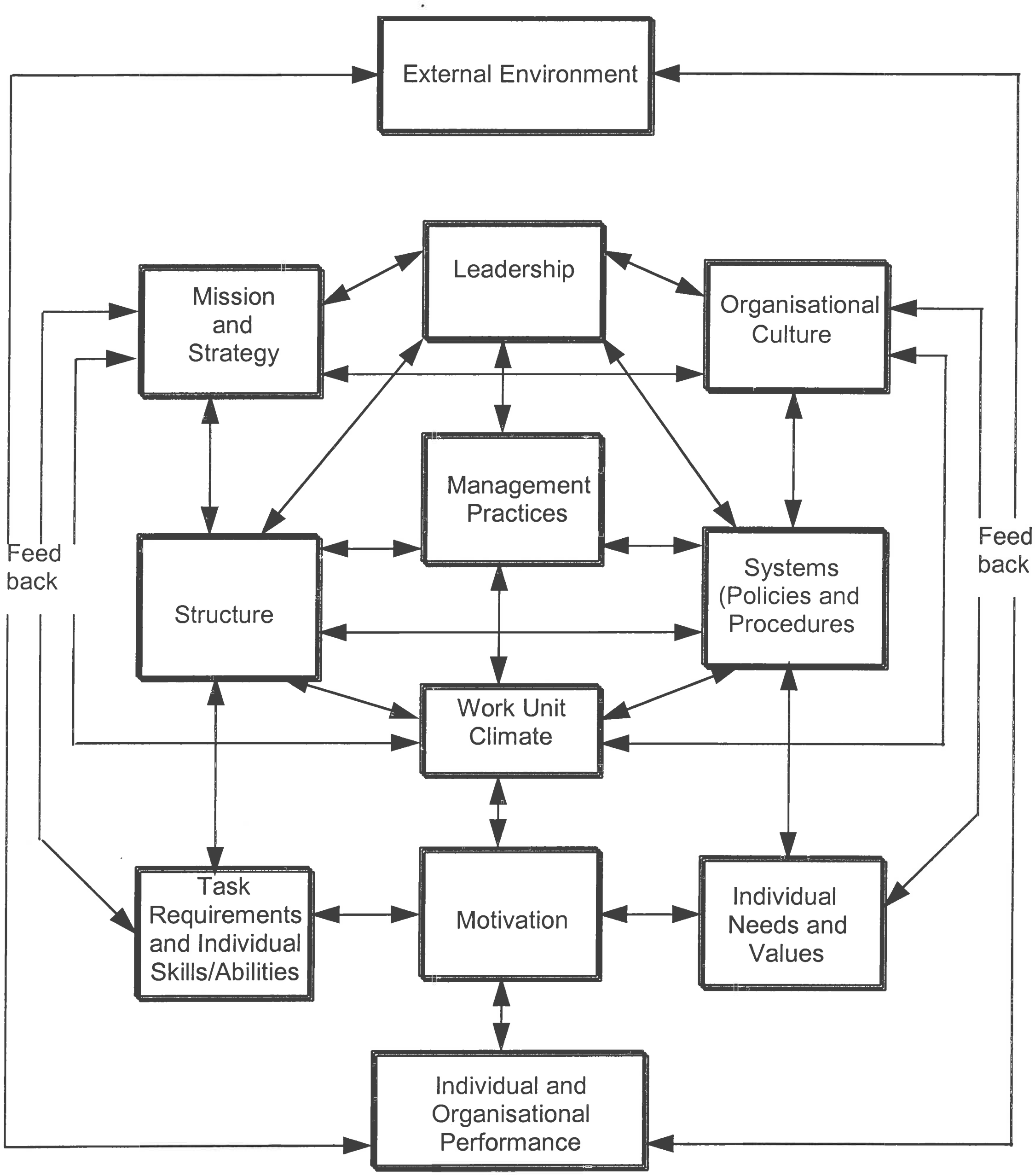


Figure 31: A model for organisational performance and change
Source: Burke and Litwin, 1992

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.

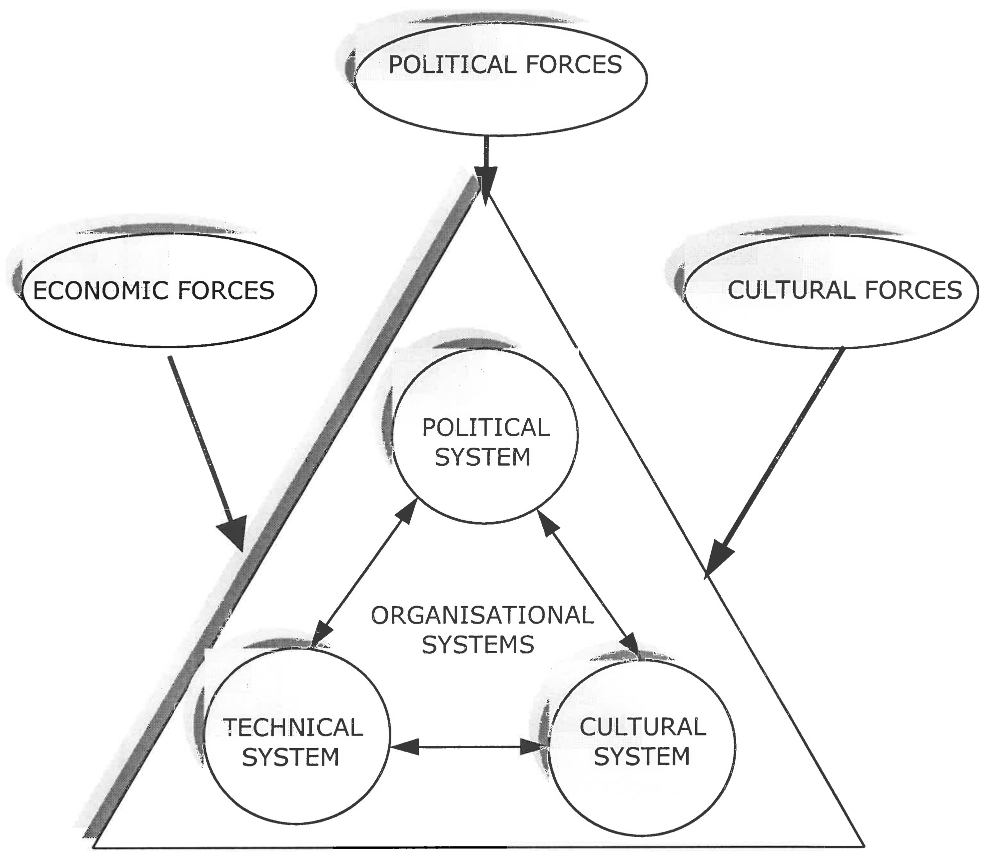


Figure 32: Tichy's TPC model showing the internal and external forces that drive the organisation to change
Source: Tichy, 1993: 242

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:

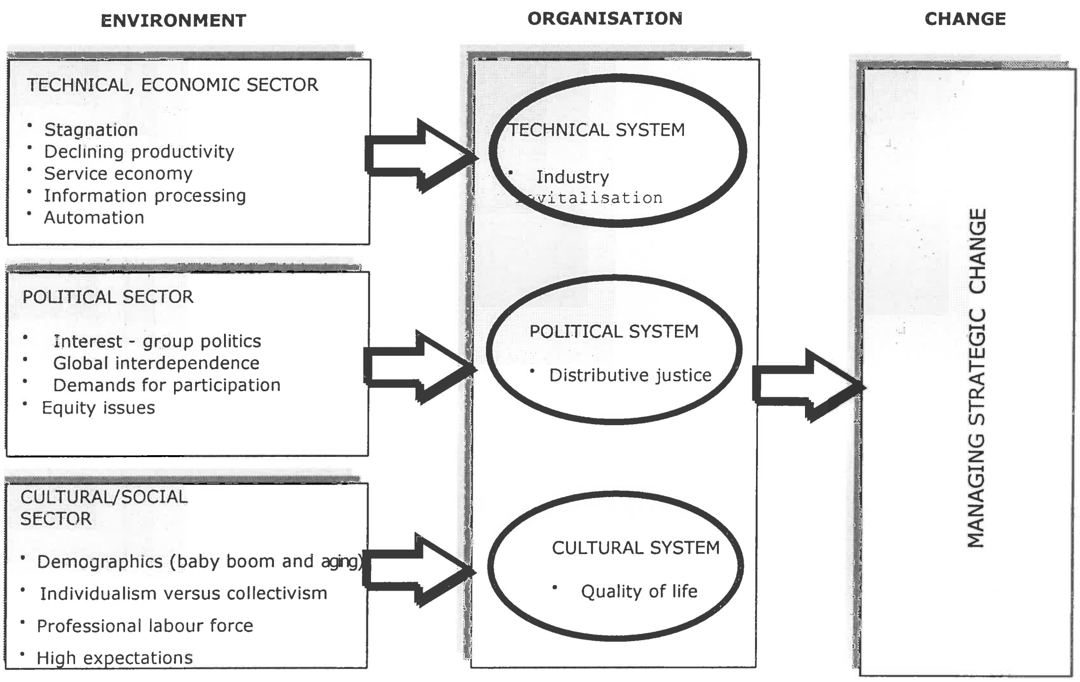


Figure 33: The influence of technology in effecting strategic change
Source: Tichy and Devanna, 1993

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:

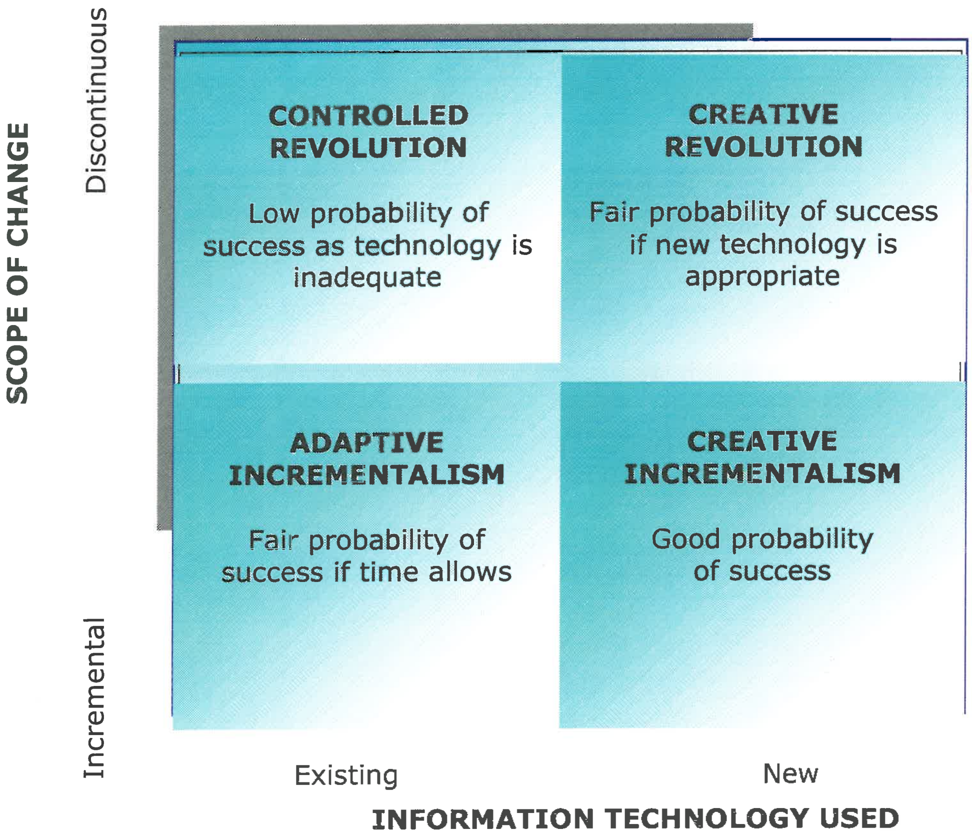


Figure 34: The link between information technology and the scope of change

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.

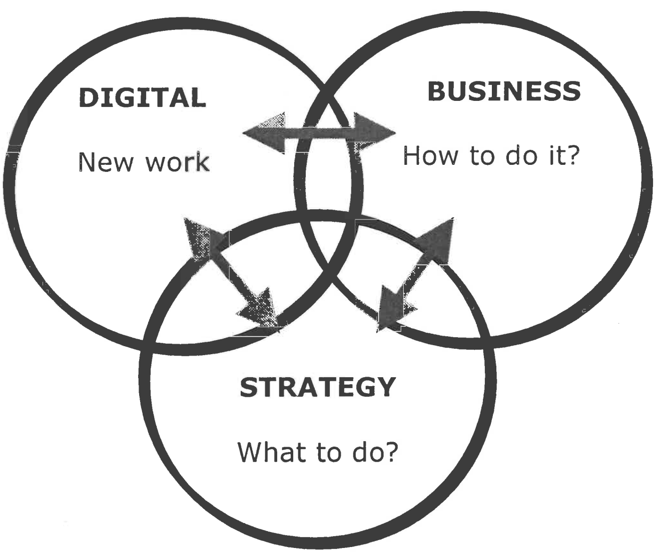


Figure 35: The multiple dimensions addressed by a migration of IT models
After: CSC Foundation Index, 1998

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.

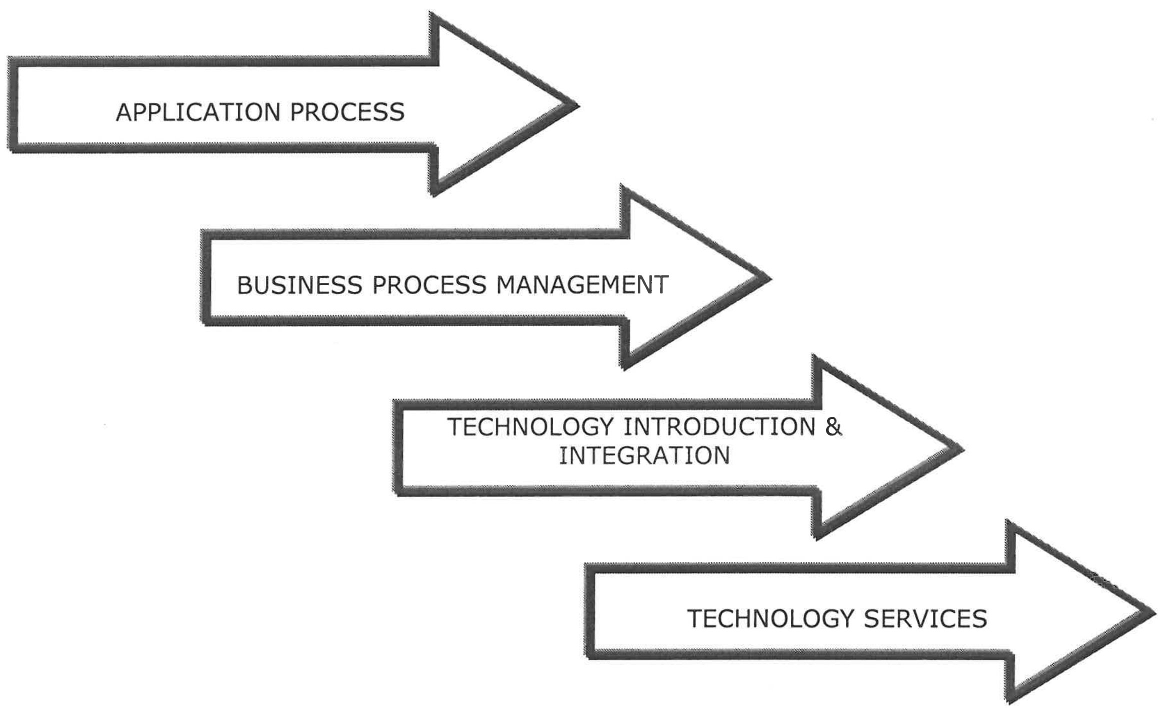


Figure 36: Processes in the Pervasive Model
After: CSC Foundation Index, 1998

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.

Infrastructure implementation
Technology life cycle analysis
Infrastructure evaluation
Architecture analysis
Educate/communicate the concept
Generic service definition
Evaluate new business paradigm
Evaluate new technical paradigm
Anticipate new business needs and opportunities
Identify new IT concepts

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	
Unattainable goals might be set	Shorter time to real benefit possible	Risk of automating inefficient processes ERP dictates processes
Could be difficult to set tangible goals	Continuity of project team and business representatives	Shorter time to systems resulting benefits
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.

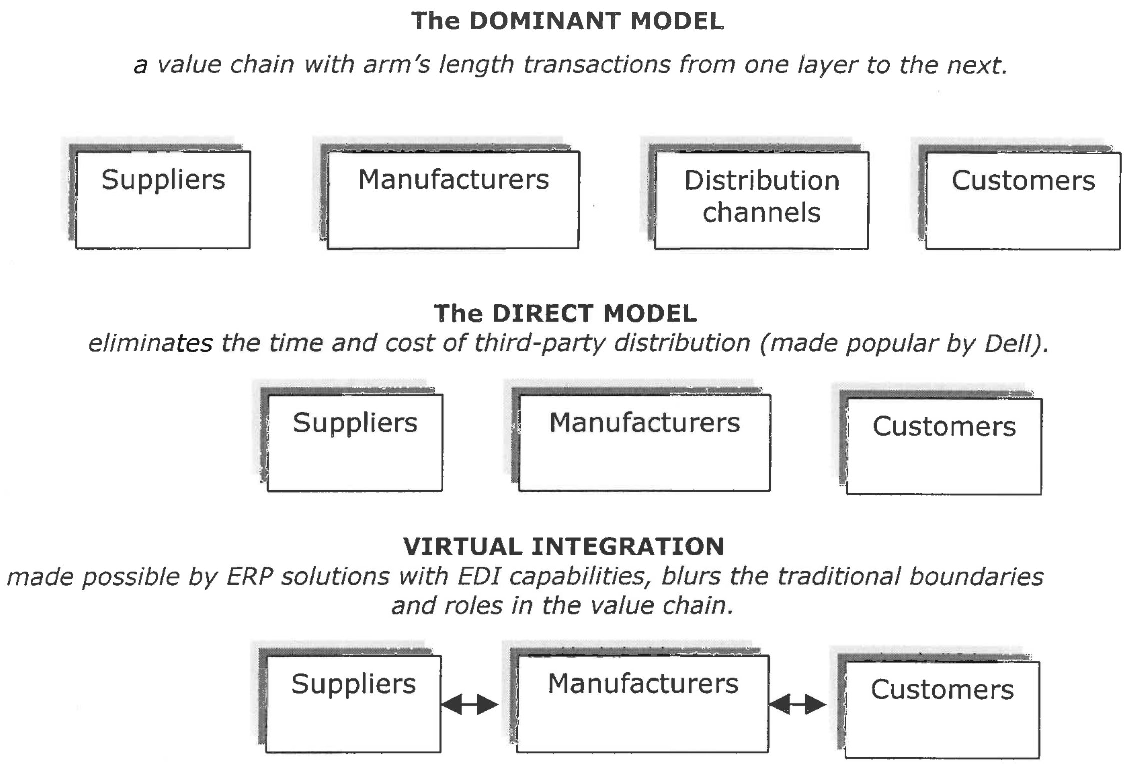


Figure 38: The evolution of a faster business model
Source: Magretta, 1998

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.

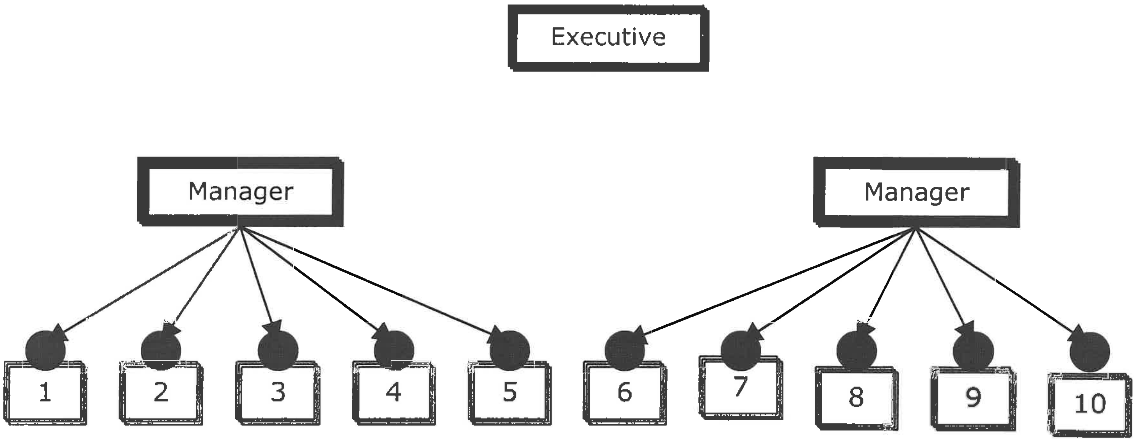
Table 29: The main focus of re-engineering – re-integration of processes

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

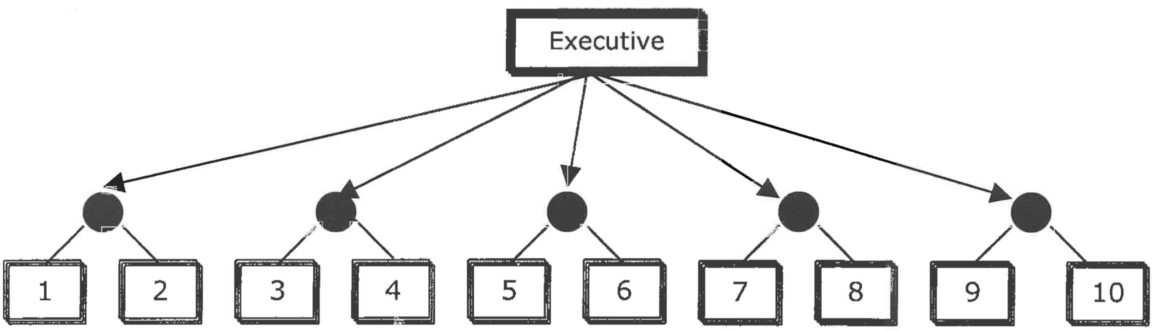
Thus, the re-engineering solution deals with at least three separate and relatively independent and differentially manageable aspects, namely divisions of task, division of labour and division of knowledge. The following figure depicts the problem with the division of labour and the subsequent solution,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

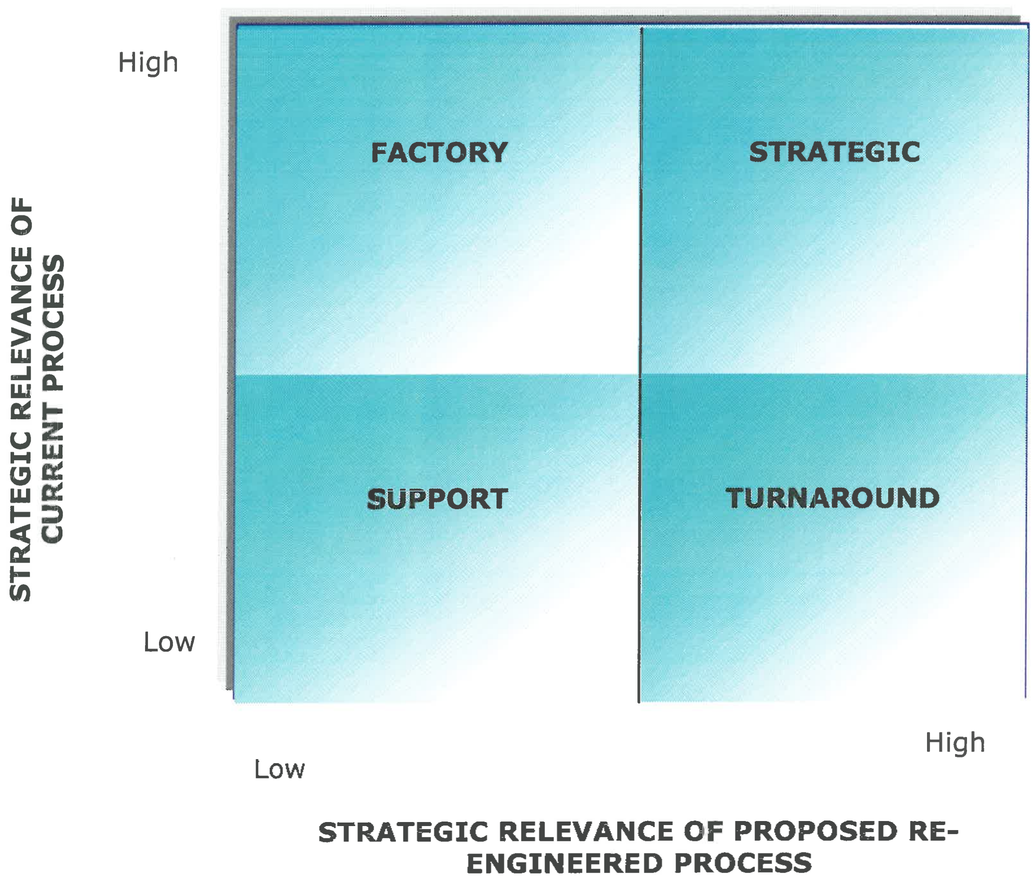


Figure 40: Strategic Relevance Grid
Source: Revenaugh, 1993

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.

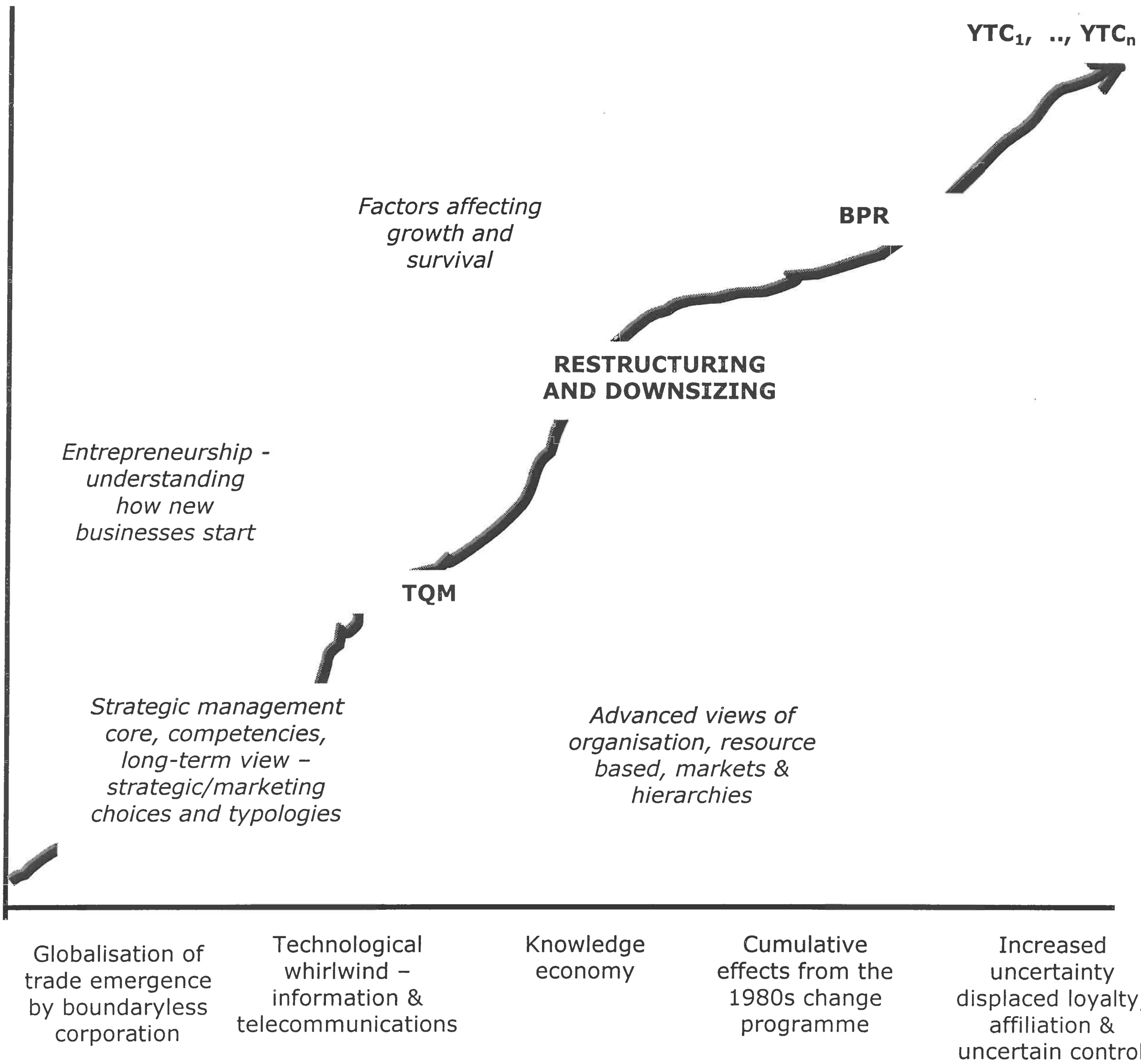


Figure 41: An evolutionary view of the new business world and important business enhancement programmes (YTC_I = programmes as yet not identified)
After: Geisler, 1997

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.

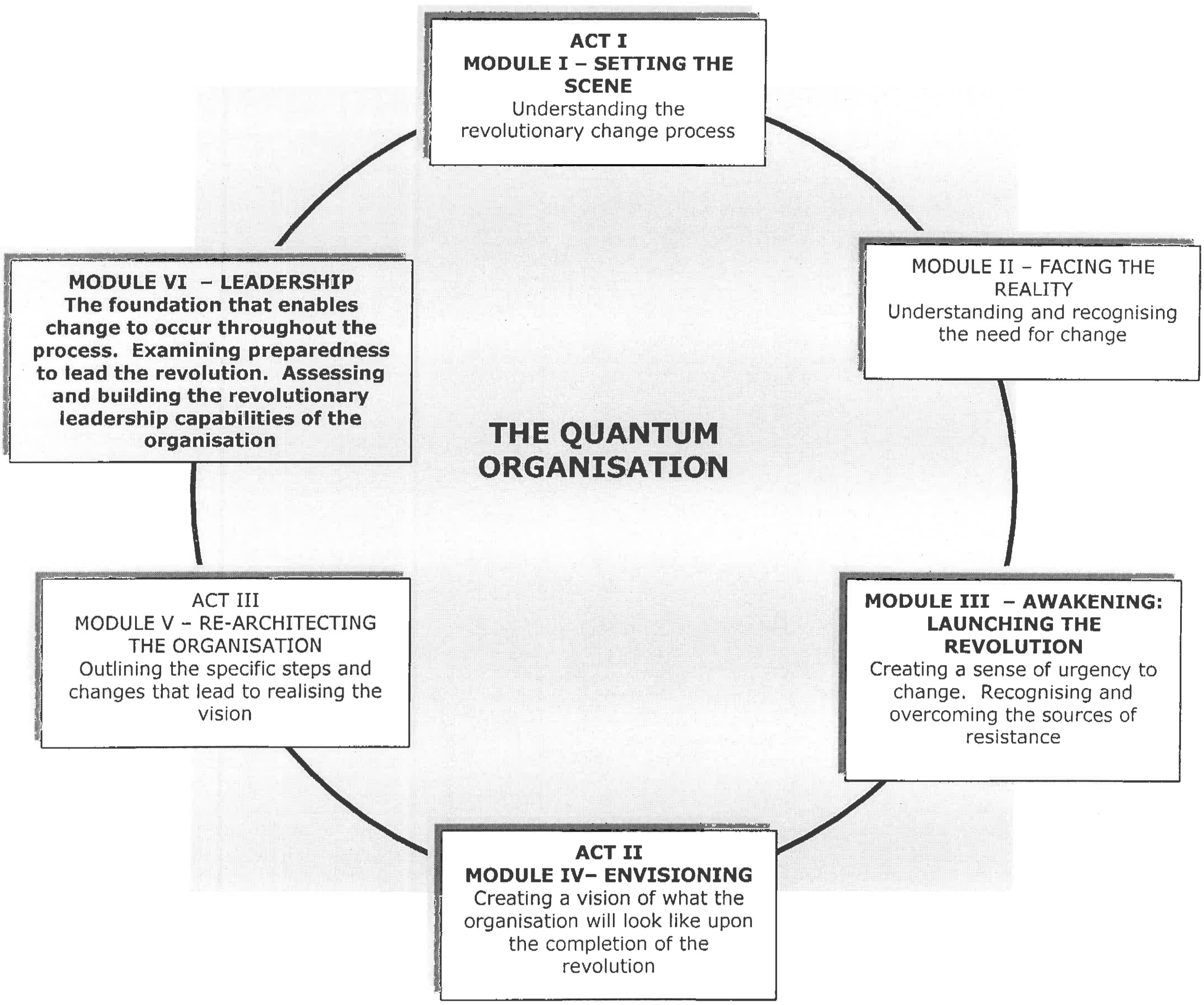
'It was our fault, and our very great fault –
and now we must turn it to use.
We have forty million reasons for failure,
But not a single excuse,
So the more we work and the less we talk
The better results we shall get.
We have had an imperial lesson;
it may mould us an Empire yet!'

Rudyard Kipling: The Lesson

MODULE VI – LEADERSHIP: TWENTY-FIRST CENTURY LEADERSHIP

'Temperance is, I imagine, a kind of order and a mastery, as men say, over certain pleasures and desires. Thus we plainly hear people talking of a man's being master of himself, in some sense or other; and other similar expressions are used, in which we may trace a print of the thing. Is it not so?
Most certainly it is.
But is not the expression 'master of himself' a ridiculous one? For the man who is master of himself will also, I presume, be the slave of himself, and the slave will be the master. For the subject of all these phrases is the same person.'

Plato: 131



MODULE OBJECTIVES

Information, obtaining information, sharing information, making fast and appropriate decisions – all requiring different forms of leadership. This module touches on the important issue of organisational learning. Learning organisations represent a potentially significant evolution of organisational culture. However, they will only evolve after the leadership abilities they demand, have been developed. This new development in management will focus on the roles, skills and tools needed for leadership in the Quantum Age and subsequent Information Wave.

A dualistic, different kind of leadership (chaordic leadership) should prevail. The components of this new kind of leadership are studied.

1. INTRODUCTION

Leaders should be conscious of corporate conventions and the fact that at some stage these could become lethal. They should be cautious of the fact that training could lead to indoctrination and even brainwashing, and help their organisations to learn to forget the lessons that mired them in the past. Organisations should develop the mental space for the birth of new ideas and totally redesign their definition of strategy. In doing so, they will be able to use existing data in order to force their way into the conventional markets and industries. Hamel and Prahalad [1994] argue that this means more than merely challenging the existing industrial orthodoxies, it means challenging *their own* orthodoxies, in other words it suggests the creation of a homogeneous mindset.

According to Hamel and Prahalad [1994], such a mindset is orchestrated by getting hold of the *pro-change constituency* - generally not in the echelons of upper management, but rather at the *periphery* of the organisational structures. (Top management as creators of the existing model are generally happy with their creation.) These people have a much bigger interest in the company's *future* than in its past.

Leadership should:

- Study the company's *core competencies* (as too often these skills are held captive by some product or market).
- Re-engineer core competencies if need be as these are some of the company's dowries that can be put to good use in its new strategy.
- Communicate the impermanency of success (leaders can instil a *sense of urgency* among the employees).

- *Democratise* the process of strategic planning by involving employees rather than seeing this as an elitist activity with top management at the centre of its gravity. (Theirs is the knowledge and this could be used to great effect.)

- Lastly, employees should be equipped with every possible tool available for the decision-making process, that is teamwork, problem-solving techniques, statistical and financial analysis.

'I am my position.'

Peter Senge, 1990a: 134

People are born with intrinsic motivation, self-esteem, dignity, curiosity and a joy in *learning*. They are creatures *designed* for learning [Senge, 1990b]. However, the systems in which they move (societal, economic, political) are oriented towards controlling rather than learning and individuals are rewarded on the basis of performance instead [Tichy, 1990]. By focusing on performance for someone else's approval, companies effectively get rid of the incentive to learn. At the other end of the scale, the need for learning in organisations is greater today than it has ever been. In the increasingly chaotic conditions of the modern era, it is not possible for the leader to stand alone. Today's increasingly dynamic and unpredictable world calls for *integrated thinking* and action at all levels. The old model in which: 'the top thinks and the local acts' must give way to something new and the leader who can harness the collective genius of all the stakeholders in his organisation will be able to lead his organisation in the race ahead.

In the end it is leadership that matters the most. Its essence lies in performance. Through the lives of leaders like Winston Churchill, Elizabeth I and Mahatma Ghandi, history suggests that leadership is a means to an end. More than that, Tichy and Devanna [1990] point out that effective leadership means thinking through the organisation's mission as well as setting goals and priorities. Drucker [1994] reiterates that an effective leader knows that his ultimate task is the creation of human energies and human vision. Klempa [1995] adds that he should possess an internal locus of control, be self-directed as well as pro-active.

According to Senge [1990b], leadership in the new order should consist of the following characteristics – all principles of the learning organisation in Module V, Section 2.1:

- The principle of generative versus adaptive learning,
- the ability to create shared vision,
- leadership and the principle of creative tension and
- the leader as designer of culture.

These are discussed below.

(i) *The principle of generative versus adaptive learning:* The first characteristic of the learning organisation is that of increased adaptability. More than that, the leader must possess a generative impulse to expand his knowledge. Senge calls this '*generative learning*' (or creating) and '*adaptive learning*' (or coping). The TQM movement in Japan [Pascale and Athos, 1983] constitutes an example of the evolution of adaptive into generative learning, thereby building the first learning organisation. The concept of generative thinking explores a leap into the imagination. It requires new ways of looking at the world and of understanding and managing business. It requires the design of systems that control events. If generative learning is not possible, the next best would be adaptive learning.

(ii) *The ability to create shared vision:* Leadership lies at the heart of the learning organisation because of the kind of commitment it requires to build this organisation. The myth that leaders are great men and women at the top who set direction, make key decisions and energise the workers, merely reinforces a short-term view. Leadership is much more subtle and could in fact differ substantially from that provided by the charismatic decision-maker. The new leaders are *designers, teachers* and *builders.* They possess new skills: the ability to build shared vision, the ability to challenge existing mental models and to instil systemic patterns

of thinking. These leaders are continually expanding their own capabilities to shape their future. In short, they take the responsibility for learning.

(iii) *Leadership and the principle of creative tension:* The leader in the learning organisation is able to see clearly where the company has to go (vision) and where it is now (current reality). He identifies the 'creative tension' caused by the gap between these two. There are two possible ways of resolving the tension: raise the current reality towards the vision or lower the vision towards the current reality. It is this tension in the mind that moves individuals beyond their own physiological boundaries.

The leader knows how to use the energy this tension generates to move reality more substantially towards the vision. There is no creative tension without a *vision.* Understanding the current reality is no inducement to change. People in fact resist changes (personal or organisational) aimed at altering reality. The real urge to change comes from the image of that vision as well as an understanding of the current reality.

(iv) *The leader as a designer of culture:* Building the organisation's culture and shaping its development is an essential function of leadership. The leader is inherently a designer, teacher and steward. As a designer he is responsible for the single most important act of leadership in the organisation, that is designing the core values, vision and purpose by which the organisation operates. Furthermore, he is responsible for helping people achieve more empowering views than those within their current reality. In this regard, he assumes the role of coach, guide and facilitator. In his last role as steward, the leader operates from a sense of commitment and to shared ownership of the organisation's larger mission.

'Our prevailing system of management has destroyed our people'.

W. Edwards Deming, 1991

Leaders in the learning organisation intuitively help others see the *big picture* [Senge, 1990b]. They focus not so much on the day-to-day activities as on the underlying trends and forces of change. In systems thinking we see that the causes of organisational problems are not incompetent or unmotivated individuals, but poorly designed systems. It shows that there is no external view, but that the organisation functions as an entity. The leverage in most managerial situations lies not in detail, but in the prevailing dynamic complexities. Systems thinking shows that small well-focused actions can result in significant improvements. (This is known as *the principle of leverage* [Klempa, 1995]). Systems thinkers avoid linear thinking in which interventions focus on symptomatic fixes instead of facing the underlying causes [Senge, 1990a].

The consequences of the actions of leaders who lack systems thinking skills are devastating. Leaders who manage entirely on the level of events, dealing in visions and crises and deploying inward thinking, hurtle their organisation from crisis to crisis. People reacting to situations in this way have no control over their destiny. The leader best prepared to handle change is the one with the *generative response* to emerging trends.

Learning organisations represent a potentially significant evolution of organisational culture. However, they will only evolve after the leadership abilities they demand have been developed. This new development in management will focus on the roles, skills and tools needed for leadership in the Information Wave. Organisations simply cannot stay mired in the old territory. They need the right tools to move them out of the swamp [Covey, 1993] and into the new order.

2. CHAORDIC LEADERSHIP

The new science is also a systems discipline [Fitzgerald and Van Eijenatten, 1998]. However, the focus is not on homeostatic, equilibrium-seeking structures, but on the complex, dynamic, non-linear systems ranging from the visible universe to the lowly amoebae colony. One can distinguish between the terms *chaos* and *chaord.* The first refers to the grossly unpleasant, disruptive turmoil which followers recognise as the issue of excess and not the dearth of equilibrium, whilst the latter is simply shorthand for the clearest, most powerful and encompassing view of reality known to date (refer to Module II, Section 3.5).

The central tenet of the new science is the encapsulating fact that chaos and order are not (as the classical scientists proclaim) opposites from which to choose. On the contrary, they are two perennially intertwined aspects of the very same reality. This special kind of leadership will be referred to as *chaordic management*.

2.1 MANAGEMENT AND THE END OF CERTAINTY

Leadership's enacting role and responsibilities are determined to a large extent by their own mental model of how they see the world. This model acts like a lens or filter, translating their perceived views on reality into actions. The now humanised but still mechanistic practice of management was ameliorated by the open system's model [Figure 26]. This awakening to the organic nature of the system as discussed in Module II represents a giant step forward in managerial thought and actions. On the other hand, even this model is still founded on the paradigmatic backbone of classical physics that in turn underpins the more familiar and contemporary notion of 'Scientific Management'. This ubiquitous way of perceiving, thinking and acting in and on the organisation is so deeply entrenched in 17th century science that modern-day practitioners are reluctant to take heed of its significant deficiency, namely its unmitigated inability to ultimately explain the dynamically complex workings of the universe – let alone that entity within this universe that is known as the organisation.

It is unfortunate that leaders in industry, business and politics alike remain wedded to and mesmerised by the axioms of certainty, constancy, predictability and control. As an example, proponents cling securely to the assumption that the inherent tendency of their bio-mechanical systems is towards homeostasis (or perpetual equilibrium (E) or near-to-equilibrium (NTE) [Fitzgerald and Van Eijenatten, 1998]). These leaders regard E or NTE as the natural state and hold as their ultimate goal and objective, the retention and attainment of this unwavering stability. They generally acknowledge the system's openness to a continuous and increasing influx of energy, information and knowledge as well as its subsequent output in the form of products, services and associated waste. They have to remain alert to the ever-present danger of turbulence within or outside the organisation, since these disturbances can drive the system to the edge of chaos. Scientific leadership, by its very notion of perpetuating systemic variability, brings about the far-from-equilibrium (FE) conditions they strove to avoid.

The equilibrial mindset postulated in Module I took shape nearly four hundred years ago and remained interwoven in the paradigmatic tapestry of mainstream management. Considering the rapid pace at which pioneering explorers of the universe are unveiling the arrant partiality into its once incontrovertible laws, it remains no wonder that the cache of insights of the new science, is now embraced throughout the scientific establishment. Management has remained arguably the last bastion of resistance to the emergent new paradigm. The most remarkable characteristic of this new breed of manager is their success in transcending the current archaic model of reality and entering a new space of knowledge. This can be likened to climbing up a steep ladder – the higher one climbs, the better and more expansive the view. The symbolism behind this metaphor is significant from two points of view. Firstly, climbing higher and higher produces a systems perspective in thinking and knowledge gained, and, secondly, every rung of the ladder is deemed a metaphor in its own right – signifying mental models such as the axioms and precepts of the manager. Moreover, moving up the ladder, one is forced to negate unsuitable views from the previous ladder, while retaining new ones on the higher ladder. This corresponds to the concept of organisational learning in Module V.

Another interesting deduction from the ladder metaphor, is that the level of knowledge corresponds to the level reached on the ladder, and therefore the view (or knowledge attained) from the level above is 'invisible' to anyone who has not yet attained this. If the leadership wants their organisations to survive and to thrive, in a context of spiralling complexity, escalating flux and punctuating discontinuity, the old ways of seeing the world should be relinquished. At the same time, the infrastructure of known truths is retained and integrated into the new view. The truth is, no matter how advanced the technology, how comprehensive the IS, the size of the market share, the brilliance of the leadership, in the end it is the refusal to surrender the prevailing world view that will orchestrate the demise of the business (compare this to the Replacement Design Model in Module V).

2.2 THE RISE OF THE CHAORDIC LEADER

The shift from an Industrial to the Sytems Age has altered the nature of the workplace, the worker and the work [Tetenbaum, 1998]. During the Industrial Era workers were located primarily in urban factories where they engaged in routine work, often on an assembly line. They worked specific shifts, punched a time clock and performed tasks under supervision. A 'good' worker was reliable, passive and capable of modest manual dexterity.

Leadership will be called upon to engage in the emergent change; they will seek neither stability nor predictability. They will have to realise that messiness and ambiguity are part of the process of self-organisation and self-emergence, more than the command-and-control styles of the past. They will realise that it is futile to attempt to map the future.

Precisely how chaos and complexity theories will shape the world of work is not clear, nor are there many examples of emergent change to guide those responsible for managing on the edge of chaos. Nevertheless, Tetenbaum [1998] identifies five essential ingredients apparent to the leadership role in the new chaordic order.

These are:

- Manage the transition,
- build resilience,
- destabilise the system,

- manage order and disorder, the present and the future and
- create and maintain a learning organisation.

(i) Manage the transition: The most important role of leaders is to *lead people through the transition* from the Industrial Era to the Information Era (from the world of Newton to the world of chaos). This process entails letting go of the past and coming to terms with what is lost. Workers have to trade their safe, predictable world of work for an unstable, unpredictable and highly ambiguous one. In the new order, workers are expected to identify and solve problems, make decisions, experiment, generate perpetual novelty and, continually, learn new skills and behaviours.

Leadership will have to help workers understand the extent and reality of the dramatic changes and generate a sense of urgency about the need to move forward differently from the past. This necessitates specifics with regard to attitudinal and behavioural changes, and appropriate rewards and incentives.

(ii) Build resilience: The accelerated volume and complexity of change (for instance, multiple downsizing, restructuring, mergers and acquisitions) wear down the worker's mental and physical stamina for work. This renders them incapable of weathering yet another onslaught on their capabilities. They need a capacity to adapt and absorb even more change that lies ahead. Thus, leaders are expected to help workers increase their resilience so that they can bounce back no matter how rapid the speed and intense the complexity of the changes facing them. Leaders need to explain the nature of the chaos and emergent instability along with the principle of order in disorder.

One way of resolving this and preparing the workers is to establish corporate universities or learning centres (for instance the Motorola University) where workers are trained and prepared to continually redefine themselves and the way in which they perform their work.

(iii) Destabilise the system: In the Industrial Era, an organisation was viewed as successful depending on how close to equilibrium they operated. However, a

model that places stability at its core, restricts strategies to repetition and imitation. Thus it is dysfunctional in an increasingly complex and competitive environment where organisations depend on their innovative ability to survive.

In this context, leaders need to take to heart the role of creating an environment that elicits, supports and nurtures creativity by *deliberately upsetting the status quo*, even escalating some change while damping down others and seeking a chaordic state (or a state bounded by instability). One way to achieve this, is by keeping the system in a state of creative tension, the latter being a necessary ingredient of creativity. Another way would be for leaders to *deliberately seek disconfirmation of current beliefs,* that is to continually challenge the accepted mental models and test possible alternatives. This is difficult for both the leader and his followers, and success stories should be duly recognised and rewarded.

(iv) Manage order and disorder – the present and the future: The self-organising principle inherent in chaos theory might lead one to conclude that leadership is superfluous. However, the paradox is that leaders have to ensure that the organisation engages in enough innovation to remain competitive, whilst at the same time providing enough stability to prevent total disarray. This constellation of paradoxes consisting alternately of regularity and irregularity, simplicity and complexity, stability and instability, calls for tremendous agility on the part of leadership. In the Systems Age of 'both/and' thinking in lieu of the old 'either/or' thinking, they have to learn to balance both ends. One solution is to apply regularity, stability and predictability to the day-to-day business and disorder, irregularity and unpredictability to the future change – this effectively means having two groups (or teams) in the organisation: A present team (focusing on today) and a future team (focusing on the future). The first team could focus on internal issues whilst the second could have a more external point of convergence. Moreover, Hersey and Blanchard [1988] point out that people are naturally suited to either implementing (internal focus) or innovating (external focus). This model could alleviate most employees' anxiety and stress with regard to the new paradox.

(v) *Create and maintain a learning organisation:* Since learning is the *sine quo non* of the Systems Age and central to self-organising activities from which new systems emerge, it is the leader's responsibility to create a culture of continuous learning. It should not be an accidental by-product of everyday business, but rather, everyday problems should be deemed opportunities for learning. A culture of learning is tolerant of experimentation, failure and risk-taking. An organisation which wants to capitalise on its collective human capital, should be tolerant of conflict and healthy debate.

From the above principles it is clear that 21st century leadership calls for leaders who themselves understand and accept the assumptions of chaos and complexity. They understand - no they appreciate - a new mental model based on shifting paradigms.

2.3 LEADERSHIP STYLES EMBEDDED IN THE ORGANISATIONAL CULTURE

According to Quinn and McGrath [1985], leaders, have to fulfil their role by performing their tasks effectively, in that they must be able to work effectively within each of the four quadrants in the Competing Values Framework [Figure 26). The Competing Values Framework identifies some of the values and criteria of effectiveness needed in organisations today (These values are summarised in Table 32.) 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). Over this matrix, eight spokes denoting eight leadership styles are imposed. Any particular leadership style is complementary to its neighbours, although in contrast to those with which it is juxtaposed [Quinn and McGrath, 1985: 323]. Figure 42 indicates the competencies and associated leadership roles within the Competing Values Framework. Each of the eight leadership roles contains three competencies. They complement those next to them, and are in contrast to those opposite them. These eight roles can be described according to the twenty four key competencies or value dimensions [McDonald and Gandz, 1992] listed in Table 32.

Table 32: Shared values relevant in the context of the chaordic enterprise

SHARED VALUE CONCEPT	DEFINITION
Adaptability	flexible and changing in response to new circumstances
Aggressiveness	aggressive and pursues goals
Autonomy	vigorously independent and free to act
Broad-mindedness	accepting differing opinions and viewpoints
Cautiousness	cautious and minimises exposure to risk
Consideration	caring, kind and considerate
Co-operation	co-operative and working well with others
Courtesy	polite and respectful to individual dignity
Creativity	develop new ideas and apply innovative approaches
Development	achieve personal growth, learning and development
Diligence	work long and hard to achieve results
Economy	thrifty and careful in spending
Experimentation	trial and error problem-solving approach
Fairness	fair and provide just recognition based on merit
Forgiveness	forgiving and understanding when errors occur
Formality	uphold proper ceremony and maintain tradition
Humour	fun and light-hearted
Initiative	opportunity seizing and responsibility taking with no hesitation
Logic	rational and thinking in terms of facts and figures
Moral integrity	honourable and following ethical principles
Obedience	comply with directions and conform to rules
Openness	straightforward, sincere and candid
Orderliness	neat, tidy and well-organised
Social equity	equal to others and avoid status differences.

Source : McDonald and Gandz, 1992: 68

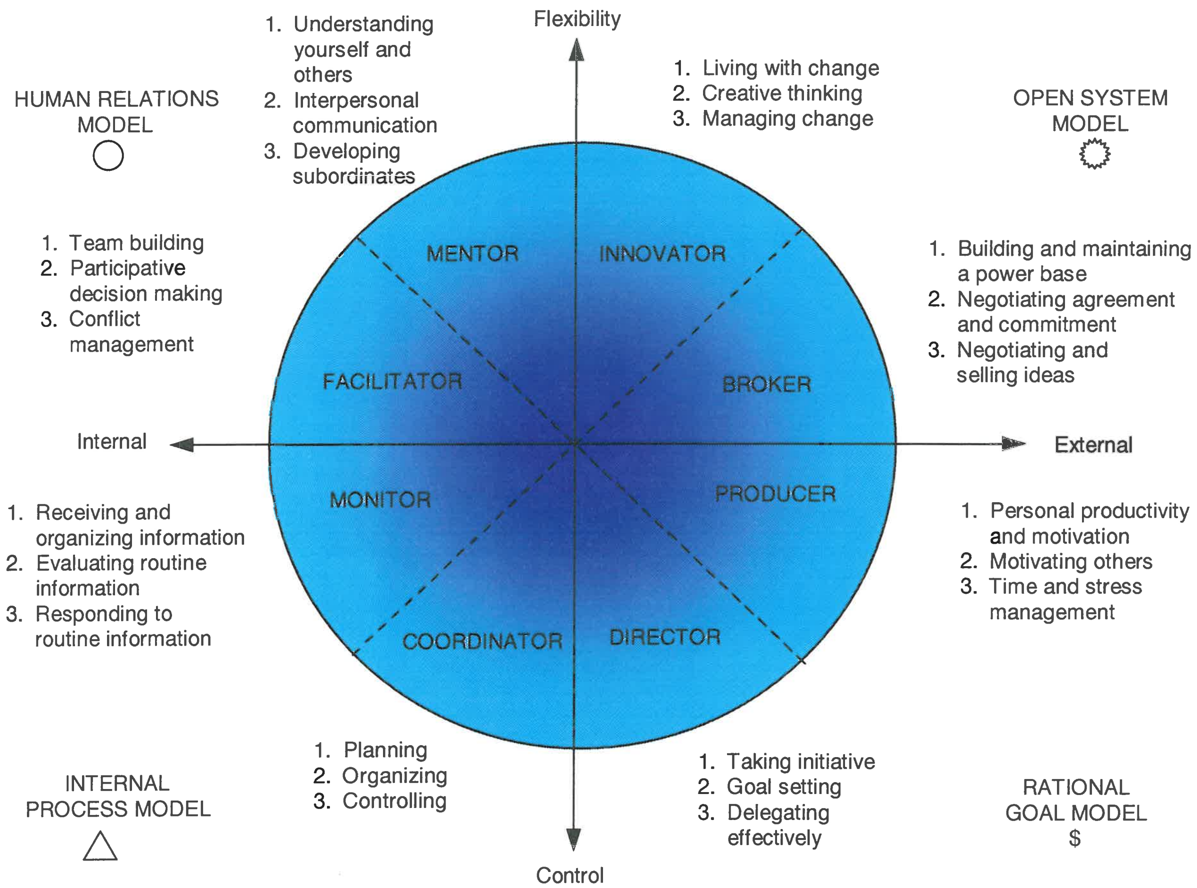


Figure 42: Leadership roles within the Competing Values Framework
Source: Quinn, 1988: 86

These eight roles enable the organisation to identify competencies compatible with their organisational culture. According to the Competing Values Framework described in Module V, all eight styles should be prevalent within an organisation – albeit at different times.

Using the above models, leaders should endeavour to derive strategies and tactics to achieve value congruence, that is, a high level of value sharing, within their organisations. These include actions designed to:

- Identify the company's set of shared values.
- Recruit and socialise employees toward the organisation's required value set.
- Radically redesign the company's value set if so needed.

According to McDonald and Gandz [1992: 71], an organisation's value set is

> ' .. *simply those shared values out of the general set, which that particular organisation has decided to emphasise and reward*'.

In other words, the set of shared values reflects that organisation's culture. Consequently, the organisation's culture should be re-architected to that effect.

It is up to the leadership to institute the change and turn this into a corporate reality. The problem is in articulating the new set and consequently making it real. A radical shift in corporate values is unlikely without a strong external impetus or change in leadership (or both). Sometimes the leader is specifically selected because of the particular set of values that he stands for.

3. LEADERSHIP IN SELF-ORGANISATIONS

Wheatley and Kellner-Rogers [1996] pose the question whether there is any role for leadership in self-organising organisations – the more so since organisations tend to move towards a mode of operation that excludes most traditional activities of planning and control. They believe that leaders are an essential requirement for the move toward self-organisation and should focus on committing their organisations to this new path.

Since the path of self-organisation is not known ahead of time, there are no prescribed stages or models. The point of departure becomes that of intention and not some set of action plans.

Employees have to be encouraged to take the initiative and explore new areas of competence. In this context, leadership has to let go so that employees can figure out their own solutions.

Self-organisation calls for very different ideas and forms of organising. It creates an environment open to the development of resilience, intelligence and flexibility. This is difficult, but necessary in the future that pulls towards new understandings with an insistent and compelling goal.

4. ORGANISATIONAL LEARNING AND SYSTEMS THINKING IN A CHAORDIC SYSTEM

The new style of leadership brings with it a dualistic way of thinking, moving away from the Newtonian style. In the 'old science' thinking exhibit an 'either/or' viewpoint, whereas chaordic thinkers have greater control over a system that can at the same time be unpredictable (or chaotic) and predictable (or orderly). According to Fitzgerald and Van Eijenatten [1998], this includes the ability to detect patterns amid the flux.

It is perhaps the greatest challenge to leadership involved in the new science to perceive the dualistic '..*both .. and ..*' [Fitzgerald and Van Eijenatten, 1998] nature of all systems. This provides a complete mindshift from the Newtonian science thinking in terms of 'cause OR effect', 'separation OR union', 'stay the same OR lose the edge'. Chaordic thinkers, on the other hand, have control within (not over) the system, whilst the system is at the same time BOTH unpredictable (chaotic) AND patterned (orderly). This empowers chaordic leadership to detect patterns amid the flux, allowing them to lash together the tatters from the reality of the old science.

Examples of pairings that scientific managers find paradoxical include: chaos/order, mind/matter, autonomous/interdependence, stability/dynamism, quality/efficiency, freedom/control, workplace democracy/financial performance and control/letting go.

5. CONCLUSION

Literature on the subject of leadership has much to say about transformational leadership [Tichy and Devanna, 1990; Hersey and Blanchard, 1988]. The premise of this thesis has been that the issue of leadership becomes far more complex in the Quantum Age to be deemed transformational. Of course, the transformational aspects of leadership are pertinent, but the demands placed upon leadership will require far more than what the gurus have been able to propose.

In terms of knowledge creating (business intelligence) activities (which will lie at the heart of knowledge creating organisations) leadership will be expected to change roles according to the changing and evolving needs of the organisation the customer and the environment (this being the notion of business intelligence proposed in Module IV).

Some of these activities are proposed below:

- *Problem-solving* (decisions regarding the organisation's present situation),
- *implementation and integration* of business intelligence (decisions regarding the organisation's internal environment),
- *experimenting* with business intelligence (decisions regarding the organisation's future) and
- *importing* business intelligence (decisions regarding the organisation's external environment).

It is evident that existing leadership structures simply will not handle the diverse nature of such leadership. They have to become Tichy's protagonists and antagonists (Module I) and *far more*. The challenges that they face in terms of the proposed chaordic leadership are daunting. The reward comes from the pockets of excellence they spread, the creation of a society (or organisation) that will deal with the aspirations of all people and the sense of doing the right things rather than being rewarded for the things that they do.

History contains powerful lessons about the fate of societies that lose their will to excel and succeed (for example, the Mayan example in Module V). Chaordic leadership is about the challenge to meet the new realities without losing the values and norms that make society (or the organisation) great.

'The wicked leader is he who the people despise.
The good leader is he who the people revere.
The great leader is he who the people say: We did it ourselves.'

Lao Tsu

EPILOGUE

CONCLUSION: HISTORY REPEATS ITSELF

'And thus, the tale was preserved, and did not perish; and it may also preserve us, if we will listen to its warnings; in which case we shall pass prosperously across the river ... and during the journey of a thousand years which we have described, we may never cease to prosper.'

Plato: 370

1. INTRODUCTION

The world is experiencing profound changes. Closer inspection of political, environmental and social events (for example, the restructuring of Eastern Europe and South Africa, global warming and AIDS) suggests that stability is rare and promises to become even more so in the future. It is possible – no likely – that the only thing that will not change is change itself. The impact of the successive waves and the resultant eras, cause a ripple effect of discontinuity (possibly more so, from the Second to the Third Waves) and make these changes substantial in magnitude and force, and sustainable in that there is no possibility for returning to pre-equilibrium. Technology is dramatically and significantly altering the ways in which society is conducting its affairs and the way in which the world is preparing for the future. Consequently, changes bring about their own challenges and opportunities. Moreover, these new dimensions bring about dramatic business transformation – the object of this, being to control the challenges and take advantages of new opportunities.

Success in an increasingly competitive global environment is constantly being explored by leadership and their organisations. Traditional barriers such as national boundaries, currencies, regulation, a strong workforce and economies of scale that once sheltered businesses are crumbling and will, in all probability, disappear. This increases challenges and opportunities for businesses. Leaders making critical business decisions by applying traditional ('old') methods will not achieve the successes that they aspire to. Competition within this new paradigm requires new rules, policies, structures, roles, leadership and organisation. It demands a radical transformation of business itself, of its processes, its leadership and its resources. The significance of business change is expanded and related to the evolution and growth in the fields of technology and, specifically, information technology. There is a significant need for businesses to align their business strategies and business processes with their (information) technology strategies as the latter (IT) is probably the most significant driving force behind change and, more importantly, the enabler of change.

2. FINDINGS FROM THE THESIS

This thesis addressed the issues pertaining to the *strategic use of information*, with regard to the organisation's IS and IT and how these could be used to effect change (or indeed to induce it). In the first **Module** the need for change was addressed by identifying the new incentives for change. Use was made of Toffler's waves and Imperato and Harari's epochs [1994a] thereby identifying the business world of today in terms of Handy's 'age of unreason' [1995a] in that the current status quo no longer serves the challenges of the new world.

Two concerns should be pointed out here, the first being that in an evolutionary world where technology is creating newer and more challenging opportunities, there is a notion of cyclicality (of repetition) – that, though the needs of society and the environment have shifted into a new paradigm (as a result of technology) these needs are in a way repetitive, with only the level of the solution to the specific problem and need, switching, similar to the K-waves in Module I. Moreover, these cycles occur at an accelerated pace (in accordance with society's needs and technology's ability to fulfil them) as can be seen from Toffler's waves (the first having lasted from about 8000BC to the mid-18th century, and the second from the 18th century to the late 20th century). There are really very few things new. The axioms on which most of what has been written in this thesis are based, have been postulated by Toffler [1970, 1980], Handy [1985, 1995a, 1995b and 1995c] and by Drucker [1970, 1983, 1990, 1991, 1994] to name but a few.

It is conceded that research in this field should be modern and contain modern references, but it is postulated that the repetitive nature of society (even one that will be largely dominated by technology, the content and usage of most of which cannot be forecast as its evolution is too fast) is such that there is relevance in the teachings of the grand masters of business.

With reference to the above, the question is whether it is then still possible to identify (or rather, predict) future patterns and trends and in any way identify possible changes in behaviour for businesses and leadership to lead them into the digital age. This becomes more pressing with the issues in **Module II** at hand, namely those of chaos and catastrophe. That there thus be some point (in time) at which organisations should jump the curve and radically redesign their thinking about their businesses, the processes, the resources and even leadership. An attempt was made to identify this (bifurcation) point – known in the literature on the subject, as the 'cusp'. Furthermore, a distinction was made between pro-active, pre-active and reactive behaviours in the identification of that moment of inertia.

The strange and exciting phenomenon of self-organisation is explored and largely became the focus of this thesis. The point was made that chaos theory stresses ultimately reaching some (new) point of equilibrium, this following on the self-organising ability of the chaotic system. Subsequently, the **Module** identifies the notion of the self-organisation as a form of organisational structure and continues to explore the characteristics of this organisational form – that of the chaordic enterprise - in **Module III**. Several (not all new) organisational forms are studied all of which are geared towards the new resources of organisations, namely knowledge (this author prefers the term business intelligence) and the so-called 'knowledge worker'. Around these new resources 'old' organisational structures and policies will fail and businesses find themselves in the situation where they should re-engineer the ways in which they have been conducting their businesses.

Module IV consists of research into the organisational leverage provided by knowledge and business intelligence. It explores the distinguishing line between 'business data', 'business information' and 'business intelligence' and justifies the choice of the term business intelligence over other, in many ways better known terms of reference within the field of knowledge management. The fine line between IT and IS, allows one to formulate strategic and operational issues (refer to Figures 11-14) pertaining to both and links the organisation's IS to its business processes through the re-engineering diamond. In this context, the **Module** defines IT, traces its evolution and discusses the problematic area of technological forecasting. It proposes moving IT from back-room to strategic tool in the businesses of tomorrow. In this, it discusses the Continuous Strategic Alignment Model as management tool to align the organisation's business strategy with the appropriate IT strategy. A classification of information technologies is proposed and discussed, the terms of reference being the ROIT, TCO and scope of these information delivery systems.

With the simultaneous (but not contradictory) diversification and convergence of technology, the IT-enabled business re-engineering proposed by Hammer and Champy [1990], has not delivered on all its promises and **Module V** sees the development of a Technology Change Model according to which the scope of change (radical/incremental) may be weighed against the IT investment (existing/new). With re-engineering reporting many (and costly failures) it is proper to finally suggest a case for 'de-engineering' the corporation (or cleaning up after re-engineering), perhaps more so when the re-engineering is intertwined with investing and implementing ERP systems. The importance of the self-organising phenomenon becomes more relevant insofar as de-engineering is proposed to counter the re-engineering failures and misconceptions. The uses of chaos and its role in the self-organisation principle become necessary and evident to enhance the performance of organisations. The principle of self-organisation directs organisations to become more focused on letting information take its own course rather than developing new models or frameworks or employing existing ones. The principle of self-organisation presupposes no organised starting point, it lets the organisation move into confusion after which the information or organisation will, of its own accord, crystallise into new and exciting forms and ideas. Matthew Fox wrote that:

'Wisdom is about living harmoniously in the universe,
which is itself a place of order and justice
that triumphs over chaos and
employs chance for its ultimate purpose.'

In keeping within the scope of Tichy's model for change (Figure 1), which has been used as a road map for this thesis, the research finally turns to the most important issue of new and changing leadership in **Module VI.** Tichy himself has been actively involved in the field of transformational leadership [Tichy and Devannna, 1990], which focuses around change, innovation and entrepreneurship, the vehicle of all of these being technology. Organisational learning and the Competing Values Framework are studied within the framework of chaordic leadership.

3. A REAL PARADIGM SHIFT

The value gained from information, the use of knowledge and the application of (business) intelligence has been debated throughout this thesis. That this will result in a paradigm shift is evident. When a paradigm does shift, it affects the way that people look at the world and the way they understand it, so that patterns and logic are totally new and the existing pattern and logic are no longer valid. The shift in paradigm (through the Quantum Era to the Third Wave) is not only due to the advent of new technology. It also follows from the emergence of new questions. For instance, Instead of '*What type of factory should we build*?', one would ask: '*What business should we be in*?'

This provides a new perspective, with totally new views of what the world is like and how and why things seem as they are, and also what work they do. Kenneth Clark provides an excellent example of this in his treatise on the development of

Western civilisation [1969]. He focused on the year 1100 when radical changes occurred in European culture, architecture, sculpture and the people themselves. Clark notes that these changes occurred within one lifetime - not as a result of some technological breakthrough, but rather through a fortuitous release of energy and a leap to a higher plane (or new (third) wave). Real shifts in scientific paradigms appear as the whirlwind activity of some great scientist/revolutionary (like Newton) who redesigns the world in his head and leads it in a new direction.

Thus, radical change in management occurs as a happenstance combination of a leap in technology and a (possibly subsequent) shift in management technology, outlook and perspective. Such changes may be due to environmental turbulence in a manner similar to the great discontinuities in biological evolution attributable to major changes in the earth's environment (like the end of the Ice Age). The merging of the technology leap with changes in management philosophy changes do not generally occur all at once. There is generally a gap between the occurrence of these two dimensions of the radical shift in management paradigm. Shifts in management paradigm are complex and lengthy and seldom attributable to a single innovator. They are incremental rather than sudden. On the other hand, the triggering dimensions of technology and change in management philosophy come from outside the organisation and its leadership. Management scientists digest potential changes and transmogrify them into a long-term indoctrination effort which results in shifts in paradigm. There are Gurus in management [like Deming, Champy and Hammer, Drucker and Toffler], there are no Newtons, Einsteins or Mandelbrots. Knowledge in management and organisations is still merely a fragile assortment of methodologies and findings borrowed from other disciplines like the sciences. The integrated framework is still in its infancy, made more complex by the array of questions that have arisen and management's inability to field or formulate simplistic yet encompassing models of how organisations exist. Moreover, at any given time, there is not only one, but several paradigms prevailing in the management and organisational discipline – some of which are completely divergent or paradoxical.

The notion of BPR and its links with technology were studied in this thesis. Geisler [1997] contends that BPR is not so much a paradigm shift as an obsolete promise of a solution to a set of questions, that was sold to management as a manifesto for change [Hammer and Champy, 1990] – perhaps ahead of its time on the evolutionary scale of management knowledge, since it had few knowledge tools available to tackle these problems. The figure below is an attempt to provide some clarification of the above notion of current knowledge and a future solution. The evolutionary development of management knowledge is not only incremental, but progresses in saturation stages. As in the evolution of science, contributions to the existing knowledge pool (state-of-the-art), have undergone some leveling-off after which only radical movement can elevate this pool to a higher plane. Real shifts in the management paradigm are rare occurrences, generally resulting from leaps on an evolutionary scale. This movement into a new paradigm and the driving forces behind it are depicted by the following scheme:

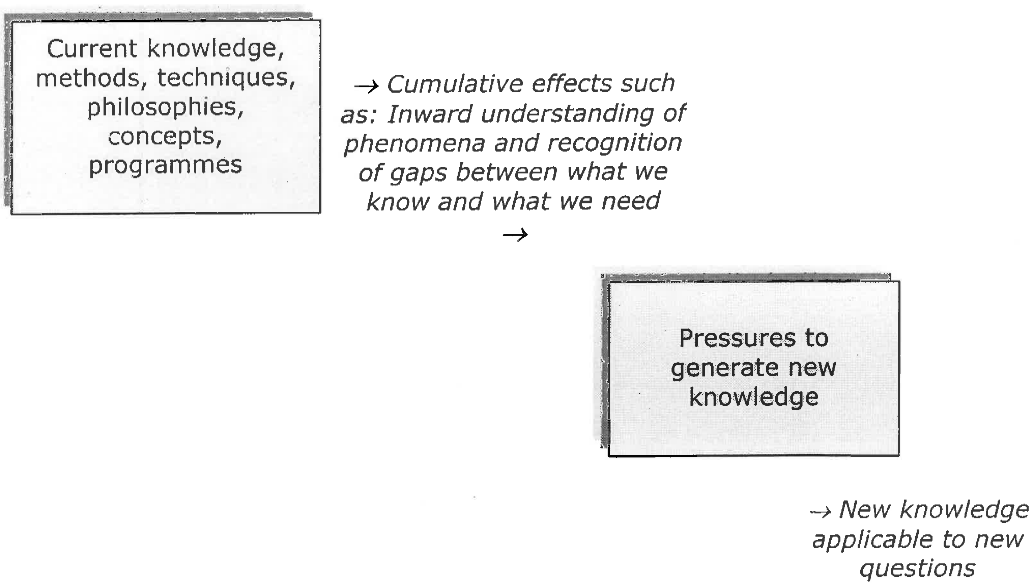


Figure 43: Current knowledge and future solutions
After Geisler: 1997: 57

It is doubtful whether research in this evolving field of radical change, information and technology, can ever be complete; whether a conclusive answer can ever be reached. The answer is arguably no. However, this thesis cannot be complete without introducing a *macroperspective*. This will be dealt with below as the final conclusion of this thesis.

4. CONCLUSIONS

In an attempt to be pro-active in business decision-making, the following guidelines are formulated here for organisations to compete in the new paradigms. These are all based on the premise that the re-engineered organisation will be knowledge-based, chaordic in structure and pro-active in strategies.

- Organisations can no longer operate under the existing paradigms and notions that have made them successful in the past. Leaders have to be innovative in reinventing the business processes or even the businesses they are serving.

- Inactivity (or the inability to change the business) will lead to doom and to failure, whereas reaction to environmental changes will result in a 'keeping up with the Jones's effect' and these organisations will always find themselves lagging behind.

- There is strategic advantage in appropriate IT/IS investments – provided that these are properly aligned with the business strategy and that the organisation follows the principles of self-organisation and chaordic leadership.

- Knowledge and business intelligence are the new competitive weapons and together with the knowledge worker, are the only meaningful resources for the business. How businesses may find ways and means to optimally use information is for them to decide.

- (Information) technology has opened up new avenues for business ventures. Business-to-business and business-to-customers using IT (for example, the

Internet) are two examples of the emerging digital commerce. Trading through this medium opens new markets to businesses, especially on a global level, and crosses all organisational, national and international boundaries. Moreover, strategic alliances and partnerships support businesses through transformations (via joint ventures, minority holdings, syndicates and intelligence exchanges). These arrangements may also make large organisations feel smaller and closer, enabling them to target and service custom markets. New partnerships are increasing, in part to support organisations moving into global markets. Globalisation of the organisation and its business, reflects the view that businesses will compete in a borderless environment. One consequence of this is that rivalry among businesses is accelerating as global boundaries are blurring.

- With the advent of new technologies, there are continuous threats posed by new entrants and substitutes (in terms of both products and services) and the bargaining power of suppliers and buyers is strengthening. Success in global markets requires more flexible and agile organisational structures.

- With a shift in the work force from blue collar to white collar, to knowledge workers, a highly skilled, customer-focused and self-directed workforce is emerging, performing highly specialised and complex tasks that capitalise on their intellectual abilities. They require increased learning support together with the ability to share information, knowledge and wisdom to get leverage out of their intellectual capital. This leverage includes creating and obtaining new knowledge, disseminating it, embodying it in the development of new products and services, and fostering collaborative team learning and systems thinking throughout the organisation.

- Leadership roles and skills are altering the traditional role of the manager from controller to coach who inspires, guides and develops employees. There is a movement away from Taylorism towards flexibility, empowerment and integration, with fewer managerial levels and the replacement of vertical hierarchies by horizontal networks.

- The new strategy transforms the Second Wave legacy of mass production into the new imperative of mass customisation. The latter supports the ability to rapidly redesign, produce, price and deliver tailor-made products and services to meet the changing customer needs at optimum price. Consequently, mass customisation forces flexibility and quick response rates from organisations. They generally use *evolutionary* process change to attain *revolutionary* change in products and services. This anomaly presupposes the need for de-engineering the business and its processes.

- Developments in technology are increasing exponentially and this results in a demand for state-of-the-art strategic use of technology, which leads to innovation. Moreover, the pace of technology will continue to increase and be magnified by the new network of communication opportunities. In this context, traditional financial approaches to evaluate the value of the IT investments (for example, forecasting costs, revenues, NPVs ROIs and break-even analysis) are no longer appropriate to handle the complexities of the internal and external environment of the modern business world – the reason being that customer satisfaction, quality, flexibility, cycle time reduction and employee morale can no longer be measured according to the old yardsticks. In this, IT's ability to measure capability for product variety, time to market reduction, error reduction rates, transaction volumes and the reporting thereof, are examples of business value that should be considered. It is suggested by this author that concerns regarding ROIT should be less important than the concern for the *value of the information* as an economic asset, and the competitive and strategic advantage gained from the leverage provided by information, business knowledge assets and business intelligence.

It has been shown how systems, technologies and knowledge move across the indefinable lines that divide organisations. Boundaries seem to disappear because technology removes them or makes them redundant. Sometimes boundaries appear where there have been none, because technology puts them there. Knowledge diffusion encourages the development of new and existing competition locally and globally. Increases in knowledge (particularly in the form of technologies that embody new knowledge or uses for new knowledge) disrupt the stable patterns of investment, of employment and of organisation structures.

The new platform of knowledge for competitive advantage and the explosion of technology re-engineers modern-day organisations and their structures in ways that are unimaginable at first. Organisations as physical entities serving the community in which they are located, are fading. Organisations of the Information Wave are *virtual*, they compete in the new paradigm of service, and they do so using the most competitive weapon of all – that of knowledge and intellectual capital. The latter may be the only asset they own. Employees become *partners* and are specialists in their fields. They generally work from their own environment and do their business across the globe, using (and creating) new technologies. This is the age of *re-engineering* and *re-inventing* the ways in which the world is conducting its business.

This thesis to a large extent focused on re-engineering, re-architecting or revolution. It captured the core challenge of Act III of Tichy's model, and in this, it explored the notions of rule breaking and of boundarylessness in unfreezing from the current state (even wave) and refreezing into a new state (even wave).

The organisational boundaries may include:

(i) *Vertical boundaries*: Delayering the hierarchies.

(ii) *Horizontal boundaries*: Breaking down of walls, for instance using cross-functional teams, project teams and partnerships.

(iii) *External boundaries*: Breaking down of the barriers between a business and its suppliers, customers, competitors and other external stakeholders, for example, creation of alliances, measuring customer satisfaction and relationship marketing.

The key to all of the above, lies in the social architecture – the people (who?), timing (*when*?), activities (*what*?) and space (*where*?). Thereafter, the issue becomes one of continuous revolution.

As the modern management structures rose out of the ashes of the Great Depression at the same time as the modern map of nations did, so shall this new order enterprise also see its analogy on a macrolevel. Chaos has pervaded the realms of the twentieth-century nations. Control over space, geographic borders and structures has slowly but surely declined. Within this seemingly chaotic and terrifying system, global disintermediation is more and more predominant. Supranational states like NAFTA or the European Union will increasingly have more power than will the countries themselves. An overall erosion of the traditional state is taking place.

5. A FIXED SOLUTION?

This situation poses new questions and few answers. For instance, how can the idea of the nation state and its service role in the community and business environment be protected if the very foundations of its existence are in question as a result of the disappearance of boundaries? Indeed, what new forms of international collaboration and state-like institutions will be required to serve the challenges and opportunities of the Information Wave? Will the growth and reach of knowledge throughout the globe change the nations of the earth and take the world into the Fourth Wave?

Solutions, according to Wheatley [1994], are temporary events, specific to a context, developed through the relationship of people and circumstances. Niels Bohr, in conjunction with Heisenberg, believe that [Wilbur, 1985: 20]:

> *'.. great innovations, when they appear, seem muddled and strange. They are only half understood by their discoverer and remain a mystery to everyone else. But, if an idea does not appear bizarre, there is no hope for it.'*

Finally, let us consider Ralph Waldo Emerson's [Eiseley, 1978: 214] image of society (one application of which is business) as an ongoing encounter with the unknown:

'We wake and find ourselves on a stair; there are stairs below us which we seem to have ascended, there are stairs above us .. which go out of sight.'

These will be the questions and discoveries to be found in the new millenium. Did Plato envision this future?

'What sudden onslaught, I replied, you have made upon my argument!
You have no compassion upon my uneasy loitering. Perhaps you do not know
that after I have barely surmounted the first two waves, you are now bringing
down upon me the third breaker; which is the most mountainous and formidable
of the three; but when you have seen or rather heard it,
you will think my conduct quite excusable, and you will allow
that I had good reasons for hesitating and trembling to broach a theory so
startling and to undertake the investigation of it.'

Plato: 185

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2. DISCUSSIONS

Conversations and in-depth discussions with (IT) directors, managers and professionals in South African organisations – especially with respect to

- The implementation and use of the information delivery systems and their relative importance with respect to re-engineering mentioned in Modules IV and V.
- The technology Change Model presented in Module V and validated through discussions with change agents and consultants in various industries.

3. SOFTWARE

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