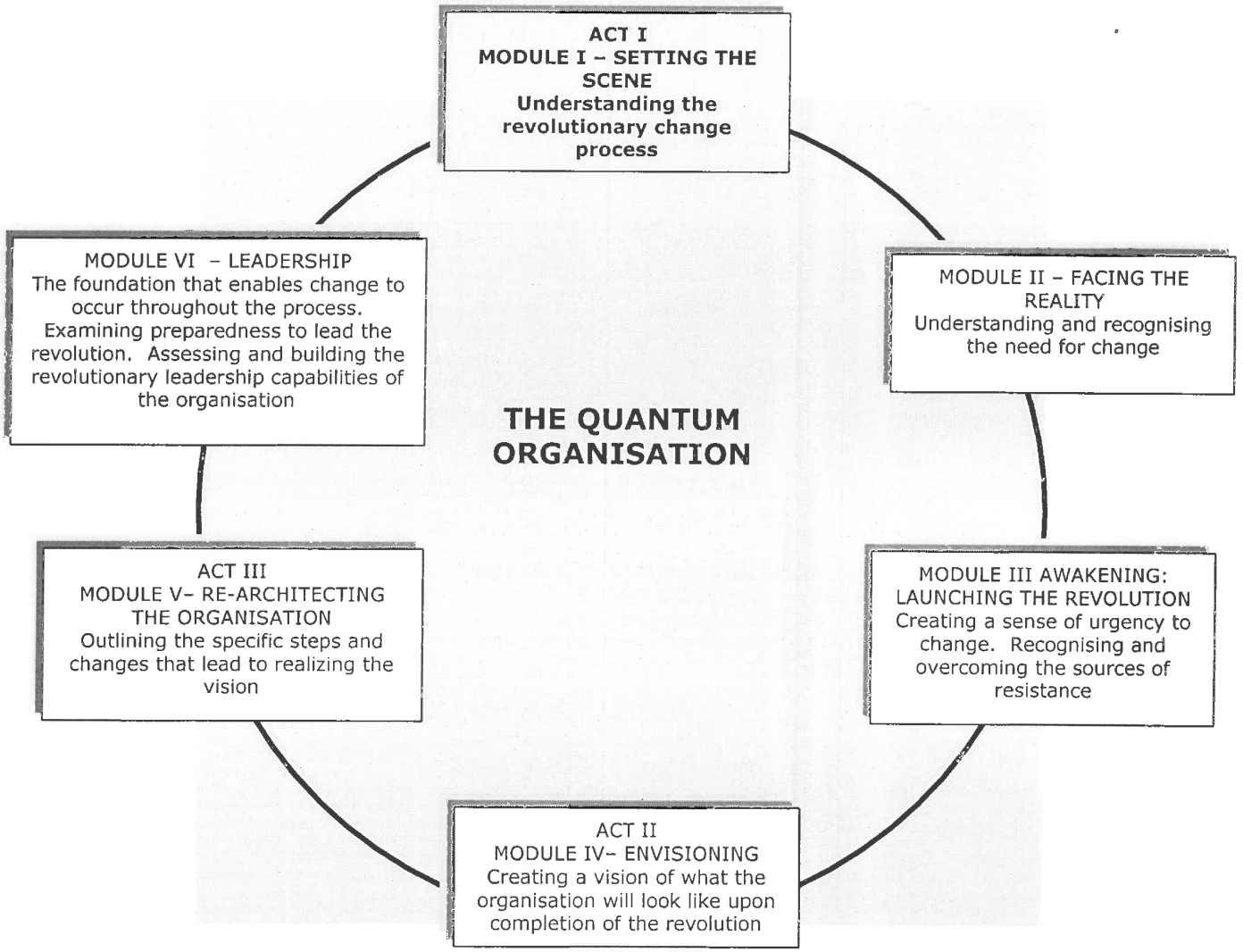
ACT I

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 18th century	Physical labour
SECOND WAVE	18th century – late 20th 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.

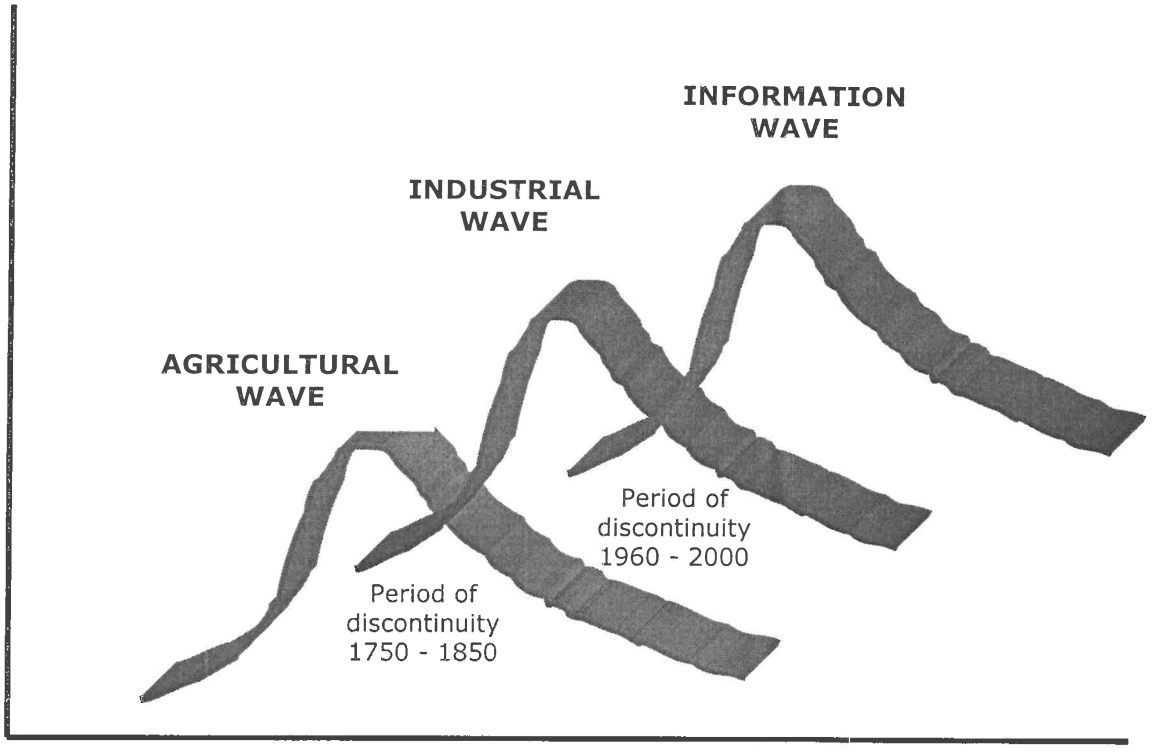


Figure 2: The three waves of Economic Discontent
After: Toffler, 1980

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.

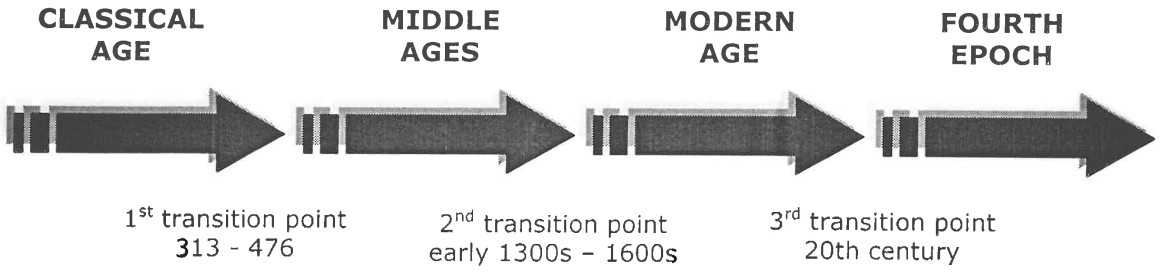


Figure 3: Epochal time line
Source: Imperato and Harari, 1994a: 11

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).

i14536791
b1426634

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.

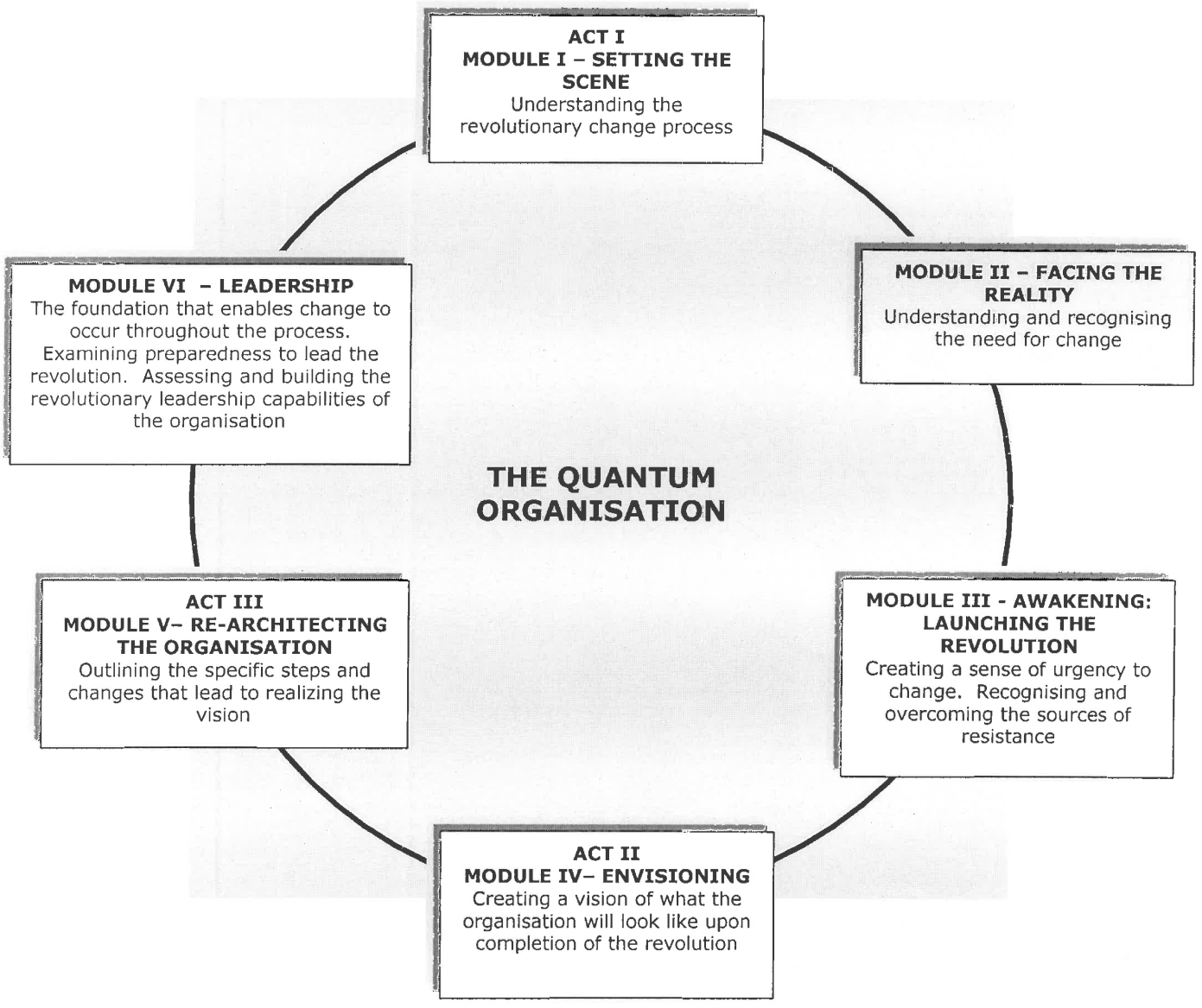
At one point in his life, he conceived the notion of applying his political science to the government of a state. He wanted to see the establishment of a state based on sound principles. Broadly speaking, Plato's *Republic*, spells out the nature of justice, derived from an inquiry, suggesting that justice 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.

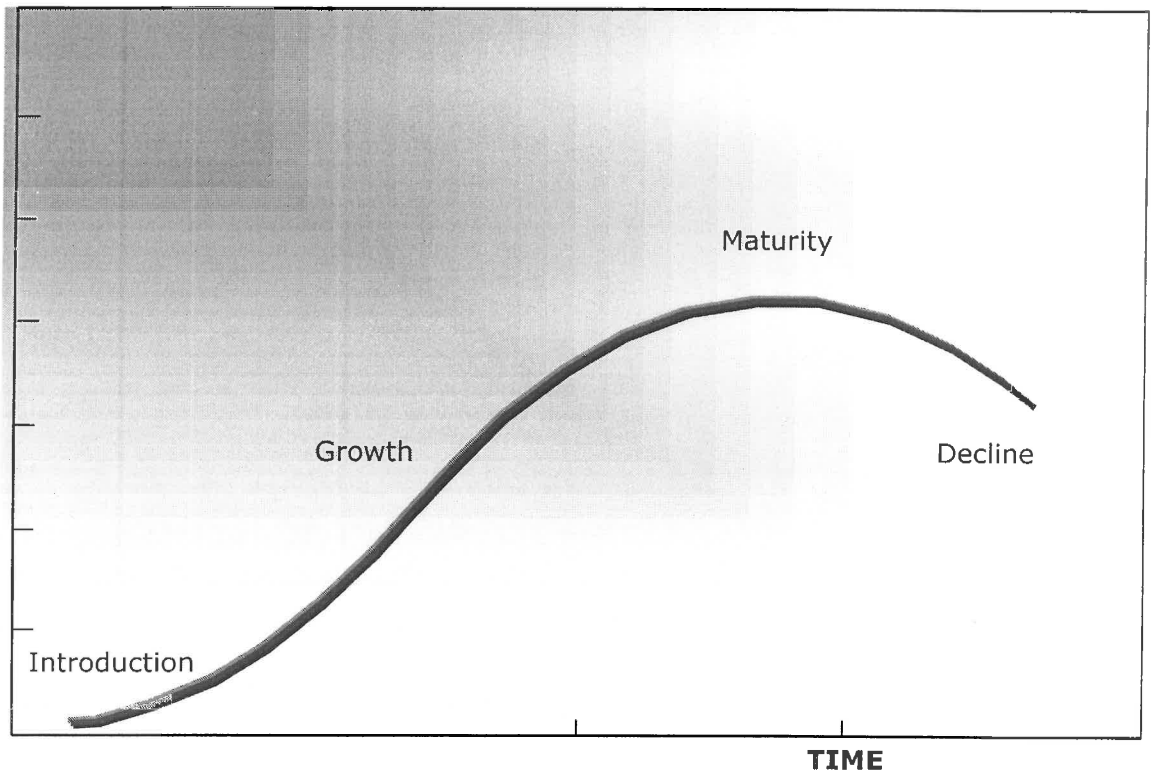


Figure 4: Handy's S-curve showing the natural business cycle
Adapted from Craig and Grant, 1993

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.

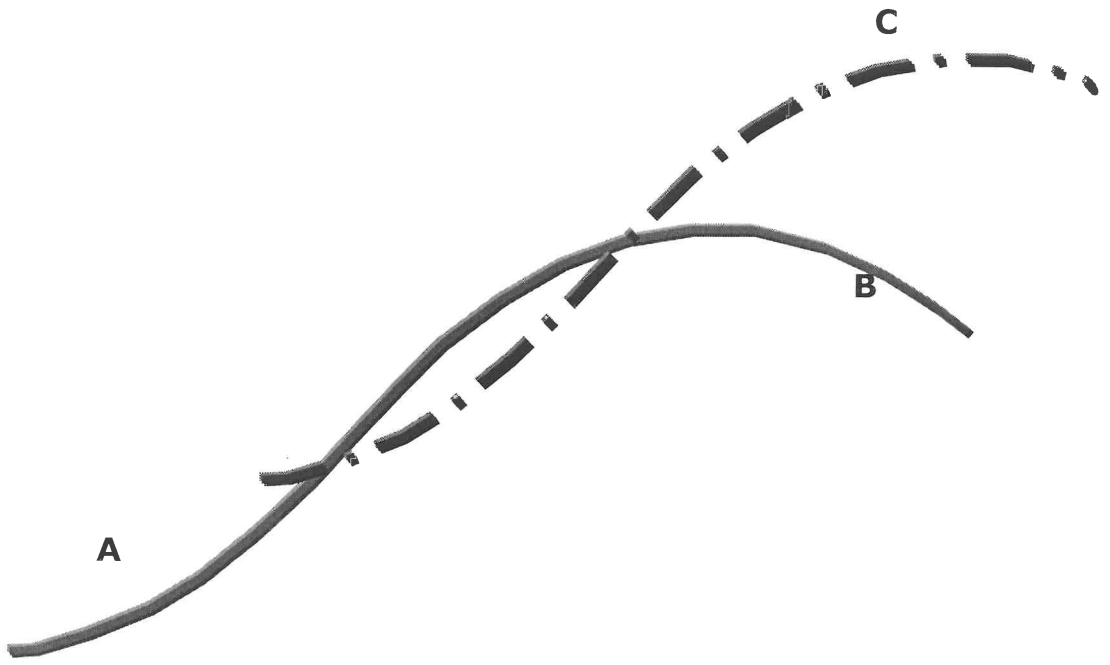


Figure 5: Jumping the curve
Source: Handy, 1995c: 51

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

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

[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 ≡ time elapsed,

S ≡ demand for business output, and

K, M and N ≡ 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

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

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

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

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

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

---

[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

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

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 $\mu_1, \mu_2 , .. , \mu_n$ and common variance σ^2. The simplest model for change in mean after the r^{th} observation ($1 \leq r < n$) is given by

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

The subsequent test statistic is

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

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 $f_1^{\theta}, f_2^{\theta}, .., f_n^{\theta}$. 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 $C_k = \sum_{i=1}^{n}(x_i - \overline{x_n})$, $1 \leq k < n$. This estimator $\overleftrightarrow{\tau}$, is not sufficient for the parameter [Hinkley, 1970] τ since the distribution of the sample $x_1, x_2, .., x_n | \overleftrightarrow{\tau}$ 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.

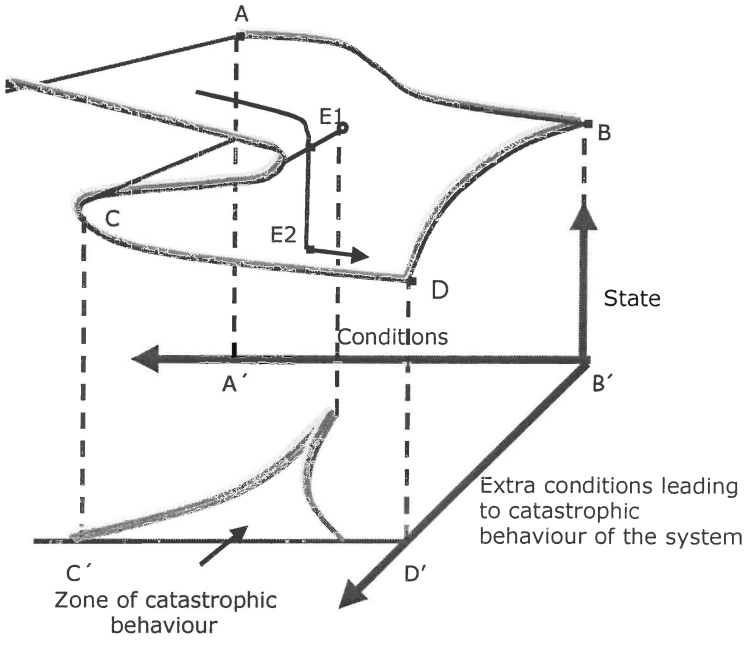


Figure 6: Schematic representation of catastrophic systems
Source: Finlow-Bates [1993: 471]

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.

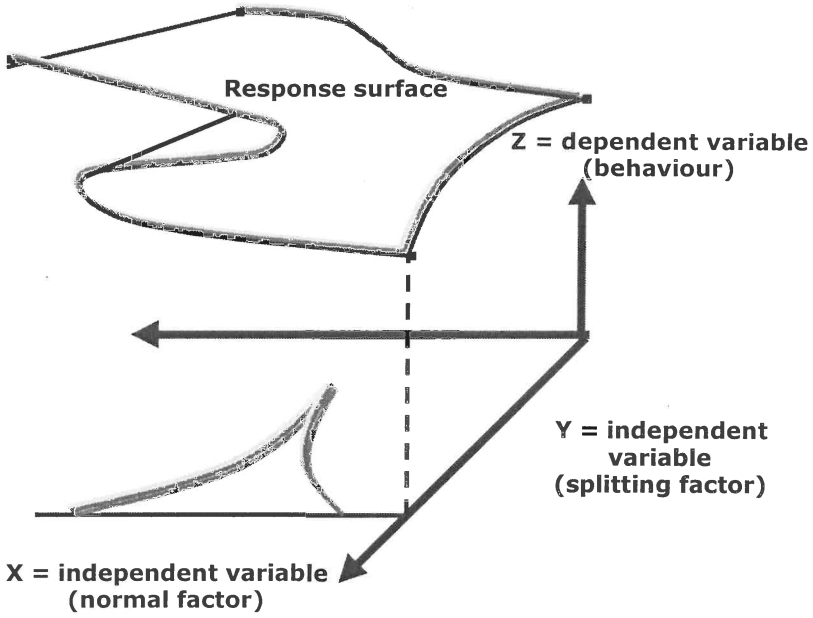


Figure 7: Generic form of the cusp function

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.

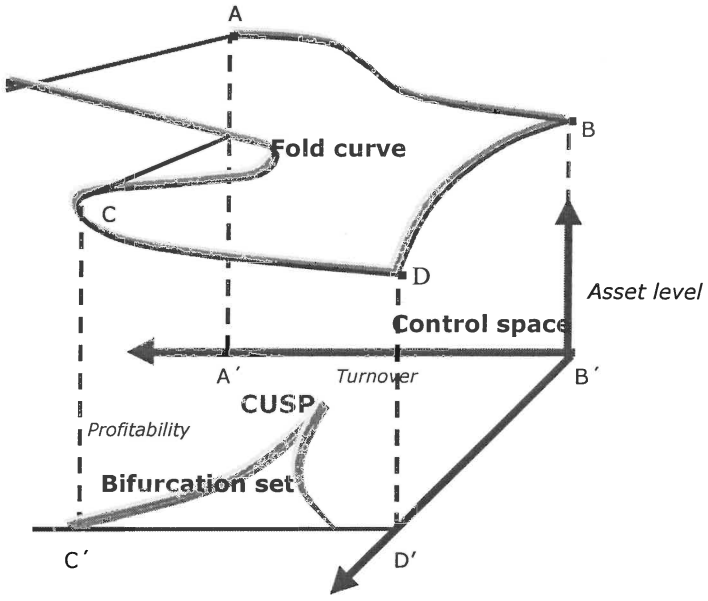


Figure 8: The catastrophe cusp model for growth
After: Aislabie, 1992

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.

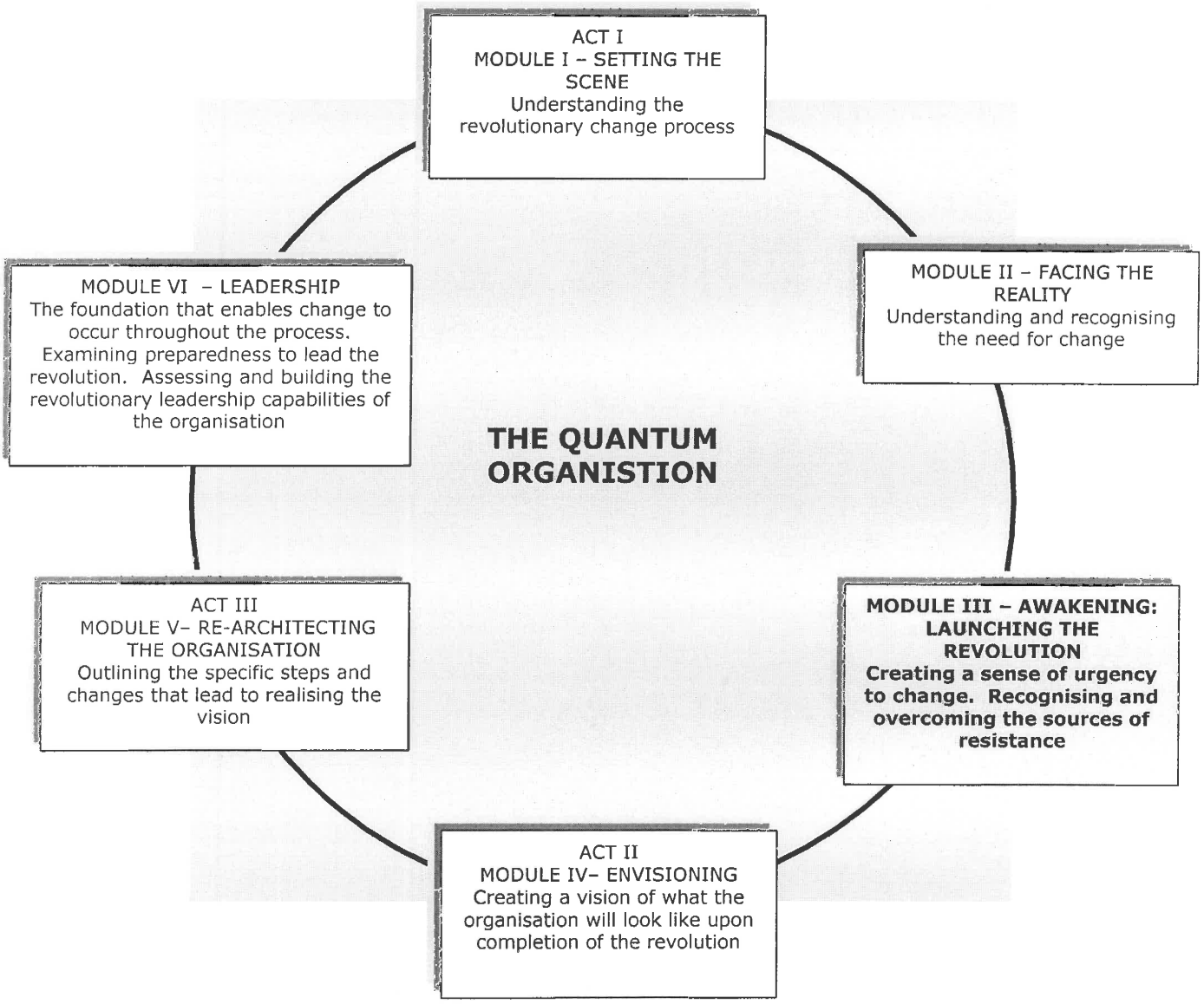
'Wisdom is about living harmoniously in the universe,
which is itself a place of order and justice that triumphs over chaos
and employs chance for its ultimate purpose.'

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.

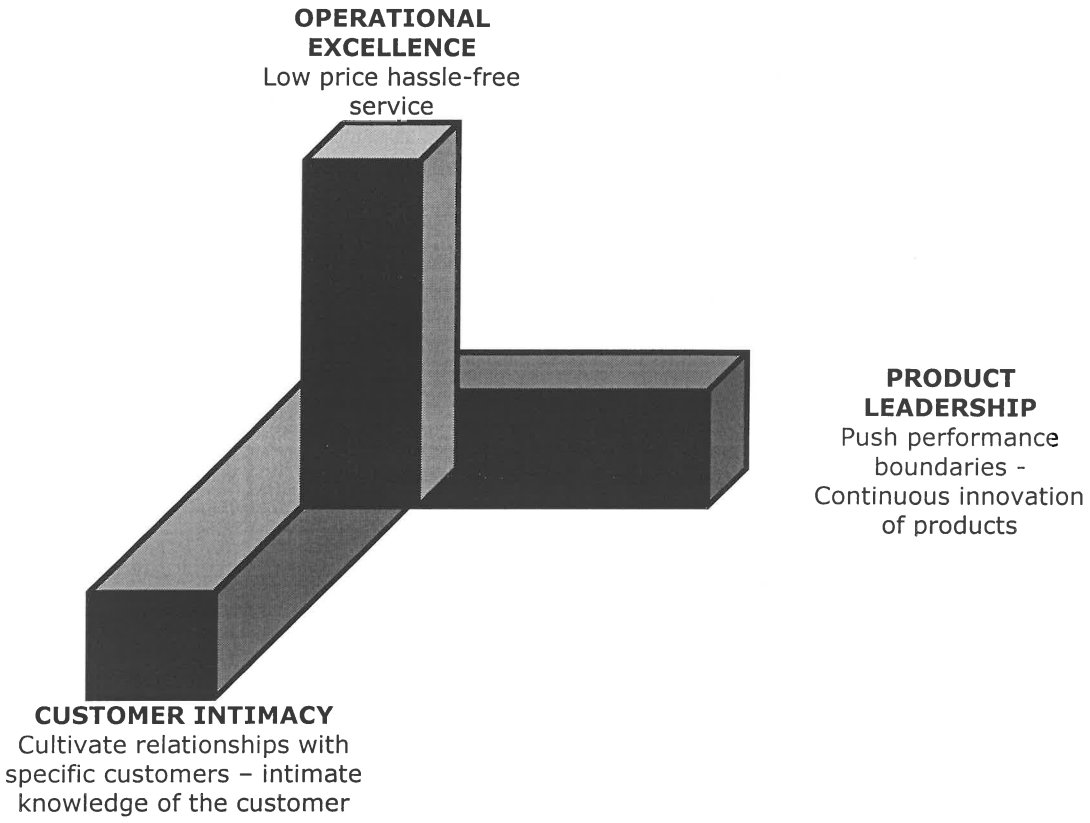


Figure 9: The value disciplines
After: Treacy and Wiersema, 1995

(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 experimentation 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.

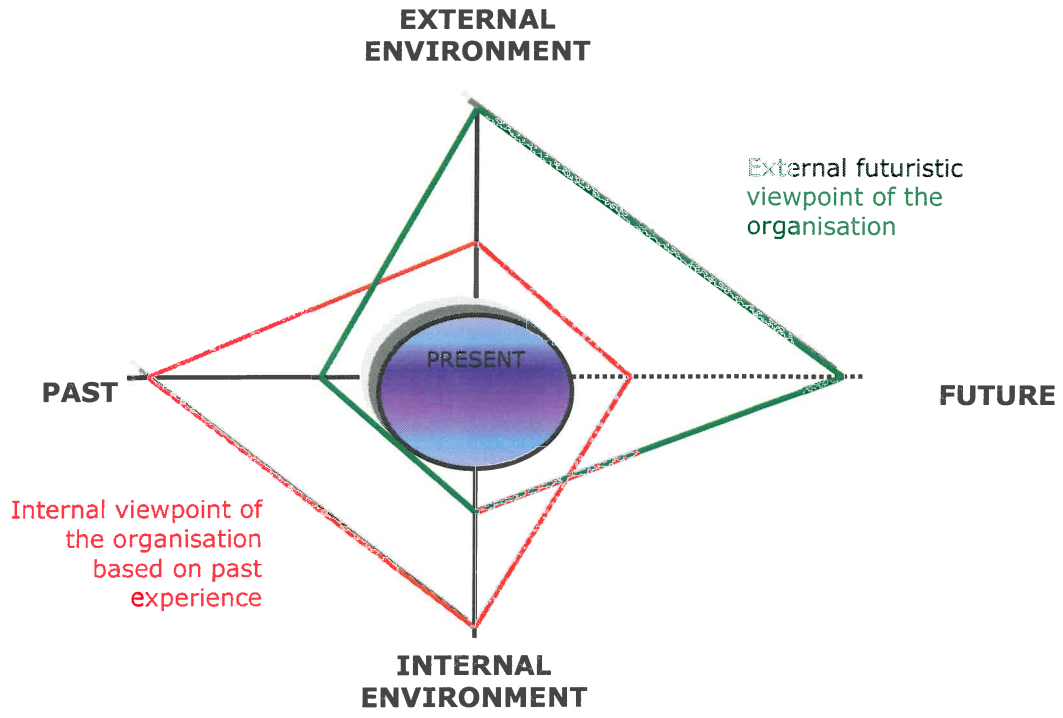


Figure 10: Schematic presentation of transforming from inward looking (focusing on the past) to outward looking (focusing on the future)

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.

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