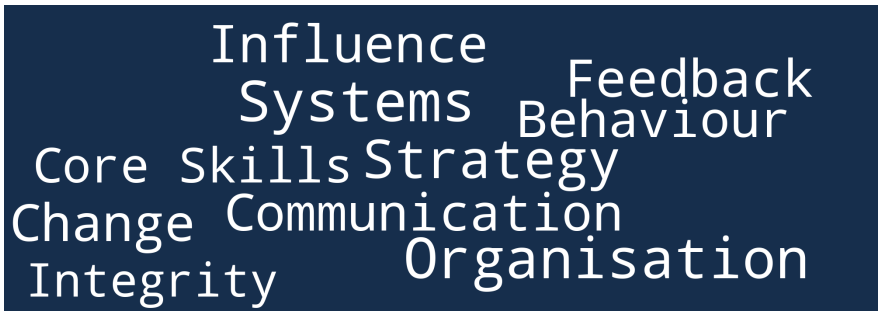

Leadership in a VUCA World

Julian Macnamara

October 2025

Abstract

This paper reframes leadership as a system of relationships, behaviours and feedback loops that shape how organisations adapt, learn and perform. Instead of treating leadership as an individual trait or a heroic act, it examines how formal structures, informal dynamics, values, behaviours, communication and decision-making interact to produce organisational outcomes. Drawing on principles from systems thinking, organisational psychology and behavioural science, the paper identifies the patterns that enable constructive influence—particularly clarity of purpose, integrity, empathy, feedback, and the disciplined stewardship of culture. It also explores how strategy, change, complexity and uncertainty place new demands on leaders, highlighting the need for resilience, alignment, and continuous learning. The result is a model of leadership grounded not in charisma or authority, but in the capacity to shape systems, empower people, and cultivate conditions in which organisations can thrive.

Contents

GLANDORE associates

Introduction

Some twenty-five years ago, I wrote a monograph about organisations - a subject I've always been fascinated by. Its focus was on:

- Organisations as Complex Adaptive Systems
- The relationship between the formal and informal organisation
- The role of leadership

This paper explores the use of named AI agents, each modeled on the published work and theoretical perspectives of leading scholars in the leadership field, to back-test the original study and derive an evolved model based on their comparative insights. These agents are not simple summarizers or mimics but are structured to simulate plausible reasoning, interpretation, and judgment in alignment with the scholar's intellectual legacy

The section on leadership, as reproduced in Appendix 1, examined the character, function, and cultural contingencies of leadership across military and corporate domains. Drawing on the reflections of Field Marshal Montgomery [1] and General Norman Schwarzkopf [2], it articulated a vision of leadership grounded in empathy, conviction, and disciplined communication. Leaders were portrayed not merely as figureheads but as enablers of collective agency—those who fostered clarity, confidence, and commitment by aligning individual purpose with shared endeavour.

In contrast to ego-driven or performative leadership, the paper emphasised the difference between inspiring others and demanding loyalty. It argued that effective leadership produced organisations that were resilient, outward-facing, and capable of internalising values that outlived the founder.

Through a comparative analysis of leading business literature—In Search of Excellence, The Winning Streak, and Managing on the Edge—the paper identified three dominant leadership modes: managerial, transformational, and charismatic. Each was associated with distinct strategic outcomes, though only transformational leadership was seen to catalyse enduring cultural renewal.

1 Field Marshal Montgomery (1887–1976) was a British military leader who played a prominent role in the Allied victories in Africa and Europe during World War II.

2 General Schwarzkopf was Commander-in-Chief of the Allied Coalition Forces in the Gulf War, 1990-91.

Case studies, particularly of IBM and Chrysler, illustrated the consequences of leadership misalignment and highlighted the value of tension between complementary styles (e.g., CEO–COO pairings). A psychological framework was also proposed, mapping leadership traits onto a matrix of power and empathy, later refined through catastrophe theory to illustrate the tipping point between productive authority and dangerous autocracy.

Ultimately, it was argued that authentic leadership was both an interpersonal art and a structural necessity. It enabled ordinary people to achieve extraordinary outcomes—and, when absent or misapplied, it eroded the coherence of the very organisations it was meant to sustain.

Whilst, the concepts were developed independently of the work of Chester Barnard, his ideas pre-date this paper by over fifty years.

In 1938, having been president of New Jersey Bell, Barnard retired to Harvard and wrote "The Functions Of The Executive" [1] - a balanced and comprehensive theory of the management process. In it, he concluded that the role of the executive was to secure the commitment and actively manage the informal organisation, whilst simultaneously ensuring that the organisation achieved its economic goals.

Barnard's view was that the Chief Executive was the shaper and manager of the organisation's shared values or culture. His essential functions were to provide the system of communications, promote the securing of essential efforts, and formulate and define the purpose of the enterprise. He noted that the organisation's values and purpose were defined more by what executives did rather than said.

Turbulent Environments

Ansoff and McDonnell[2], noting that "strategy analysis has moved far beyond the stage at which all managers have to do is write answers to three questions: 'Where have we been?', 'Where are we?' and 'Where do we want to go?'", have described a turbulent environment as one in which:

- Growth doesn't extrapolate.
- Historical strategies are suspect.
- Profitability doesn't follow growth.
- The future is highly uncertain.

Turbulent environments are caused by positive feedback operating on a system where the future, depends on, and is linked to, the past.

Chaos

Chaos theory is otherwise known as the theory of "complex dynamical systems" where random behaviour can occur in a system that appears to be ruled by exact and un-breakable laws. It is a property of many systems that incorporates positive feedback (or iteration). An example of this is shown in appendix .... which looks at how news spreads in an organisation over time and depends on the people who haven't heard the news. The system breaks down above a certain threshold which is the essence of chaos

Chaos theory had its origins in Edward Lorenz's work on weather forecasting in the early 1960s[3]. In 1961 Lorenz built a simple model comprising a system of three differential equations that attempted to describe what happens when air warms, rises, cools and falls again.

In one experiment, Lorenz wanted to examine a part of the system in greater depth. Rather than start at the beginning, he took a shortcut and entered a number from the middle of the run. This should have produced exactly the same results as the previous computer run. It did not.

The simulation rapidly diverged from the original. After a few months, the predicted

weather bore no resemblance to the original. All Lorenz had done differently in the second run was to enter the number 0.506 rather than 0.506127. Thus, a difference of 0.000127 in the model's starting value produced entirely different behaviour within a period of a few months.

If Lorenz's model is repeated over and over again and the finishing value for the last repetition is used as the starting condition for the next (in a similar way to the communication exercise), it can be shown that the behaviour of the system is totally unpredictable. Graphing the process produces the Lorenz Attractor or butterfly effect which is shown in Figure 1.

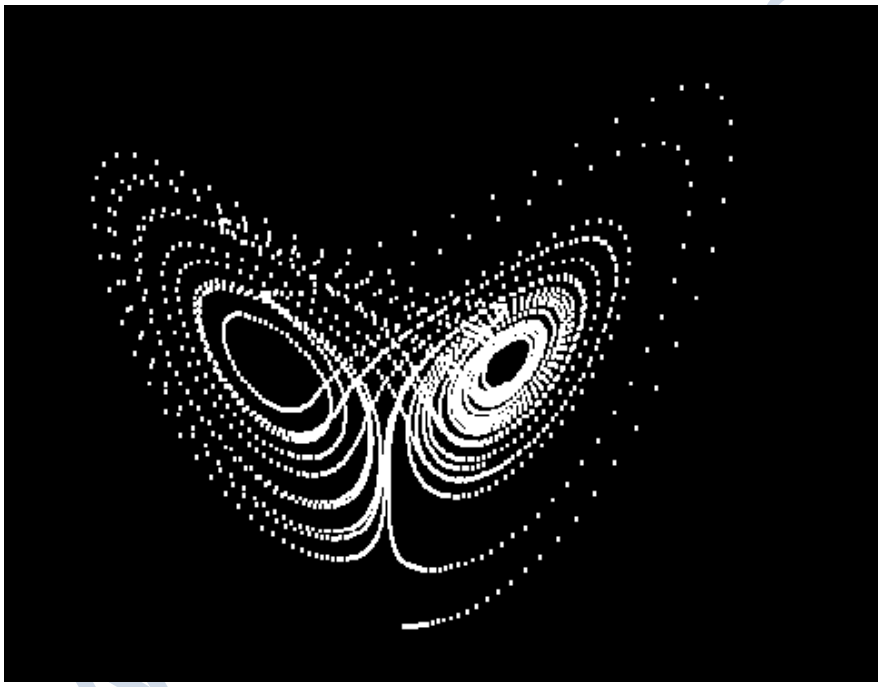

Figure 1: The Lorenz Attractor

In itself, chaos theory may, or may not, be particularly important as far as the external environment is concerned. However, everybody is familiar with the concept of hindsight which suggests that, in a number of situations, it is recognised that events cannot be predicted. Forecasters know that the most difficult thing to do is to predict a turning point.

According to the late Christopher Lorenz "rather than indulging in a costly (and ultimately fruitless) search for reliable new decision support tools, managers would do better to rely on the proven scenario approach - and, of course, on their own judge-

ment"[4]. Others are not so dismissive.

Drucker has commented that *"in any system as complex as the economy of a developed country, the statistically insignificant events, the events at the margin, are likely to be the decisive events, over the short range at least. By definition they can be neither anticipated nor prevented"*[5].

Stacey, possibly to make a point, takes a somewhat extreme position. In his view, if organisations are operating in a chaotic environment, then[6]:

- Analysis loses its primacy since the future of all successful organisations is unknowable.
- Contingency, which postulates a linear relationship, between cause and effect loses its meaning.
- Long-term planning becomes impossible.
- Visions become illusions.
- Consensus and strong cultures become dangerous.
- Contradiction, conflict, dialectics and learning become essential.
- Statistical relationships become doubtful.
- Probability only helps in the short term.
- Long-term forecasts and simulations are impossible.
- Requisite variety [1] loses its usefulness.

  Ansoff might find this disturbing since his strategic success hypothesis that a firm's performance is optimised when its external strategy and internal capability are both matched to the turbulence of the firm's external environment has been empirically validated.

This seems to be a better description of an environment bordering on anarchy rather than chaos.

[1] Requisite variety is the law that underlies the proposition that the complexity and speed of the firm's response must match the complexity and speed of change of the environment.

Most of the time the environment is not that chaotic, but it is difficult to see how there can be opportunities without a degree of chaos. However, just as nobody can predict the precise moment when it will rain, there is always some evidence that it will. This supports Ansoff's view on the importance of weak signal analysis.

Of more importance is the appreciation that systems are controlled by a mixture of negative and positive feedback. Most people are familiar with negative feedback as a means of control. Positive feedback, or the intensity factor noted by Peters and Waterman, is the opposite. It is the liberating feedback. However, just as over-revving an engine can result in its destruction, the indiscriminate use of positive feedback can lead to unpredictability and, ultimately, to chaos. If negative feedback produces order and positive feedback produces disorder, what happens at the boundary between the two.

Complexity

Neo-classical economics is an attempt to explain the creation of wealth after that wealth has been created.The world of the neo-classical economist is populated by economic agents such as firms, banks, consumers and investors. These agents have rational expectations and their behaviour can be predicted. Further, they know everything that can be known about the choices they will face in the future and use flawless reasoning to foresee all the possible implications of their actions.

This world is governed by a single law - the law of diminishing returns. Under this law, "free" markets are always in perfect equilibrium since a price will be set where supply exactly matches demand. In the world of the neo-classical economist, the equilibrium in the system is dominated by negative feedback.

What happens, however, if:

- Positive feedback is introduced into an economy?
- It is recognised that the economy reflects the decisions made by millions of real live human beings who are not perfectly rational and who have wants, desires and expectations?

The introduction of positive feedback would suggest that there is a countervailing law - a law of increasing returns. In addition, chaos theory suggests that non-linear systems, that incorporate positive feedback, have a number of interesting properties. In effect,

an economy is a non-linear system that displays both second and third-order nonlinearities. The second-order nonlinearities drives the economy toward equilibrium and stability. The third-order nonlinearities drives the economy away from equilibrium[7].

In the Principles of Economics which was published in 1890, Alfred Marshall, the great Victorian economist, recognised that, if firms' production costs decreased as their market share increased, then a firm that initially gained a high market share would have a significant advantage over its competitors.

Today, there are an increasing number of industries in which costs decline as volumes increase including most high technology industries. The concept is implicitly recognised in the "experience effect" [1] Microsoft is an excellent example of a company that makes powerful use of the law of increasing returns.

However, Marshall did not pursue this observation and it has tended to be discounted in much conventional economic thinking. At best the view has been taken that increasing returns don't happen and, if they do, the assumption is made that swift and flawless adjustments will be made to restore the market to equilibrium. Indeed, there is great evidence to suggest that the whole notion of increasing returns was, and may still be, an exceptionally frightening concept to many traditional economists. For instance, considering the implications of increasing returns in 1939, the economist John Hicks wrote that "the threatened wreckage is the greater part of economic theory"[8]. It took Professor Brian Arthur from 1983 to 1989 to have his seminal paper, "Competing Technologies, Increasing Returns, and Lock-In by Historical Events", published.

The emerging view of the economy as a complex system owes much to the catalysis of the Santa Fe Institute[9] and the seminal work of Professor W Brian Arthur on positive returns and path dependence in the economy; Professor John Holland on adaptive systems; and Professor Chris Langton on artificial life.

Neo-classical economics has been described as a value-empty discipline[10]. The Santa Fe Institute are more generous. They take the view that their approach is complementary. Their belief is that they are *"forging the first rigorous alternative to the kind of linear,*

[1] The experience effect is based on the observation that the higher the volume of a particular product a company produces, the more efficient it becomes at producing it. This principle was one of the factors underlying the development of the product portfolio matrix by the Boston Consulting Group. It was this matrix that led people to erroneously conclude that there was a direct relationship between market share and profitability.

reductionist thinking that has dominated science since the time of Newton"[11].

The Santa Fe approach to economics emphasises increasing returns, bounded rationality and the dynamics of evolution and learning.

Positive Returns and Path Dependency

A fundamental problem in neo-classical economics is that, in situations where multiple outcomes are possible, there is no mechanism for understanding precisely how one solution rather than another is selected.

The basis of part of Brian Arthur's work is that, often, an historical accident favours one technology, which might be inferior, over another. Ultimately, a small chance event multiplied by positive feedback can lead to the lock-in of this technology. Many examples can be cited including the QWERTY key board, the emergence of the VHS standard over Beta in the video-cassette recorder industry and MS-DOS in the computer industry.

Conceptually, the way this works is that if there are, say, two competing technologies that are not radically different, people will tend to make their decision by asking other people their opinion. However, every time the purchase of one of these technologies occurs, the probability in favour of the purchased technology is positively influenced. As this process develops more and more people will tend to favour one technology rather than the other. This can result in that technology becoming locked-in.

Mathematically it can be shown that this process can produce any outcome at all. Thus, the lock-in ratio could be 60:40, 10:90, or anything else. Working with the Russian probability scientists Yuri Ermoliev and Yuri Kaniovski, Brian Arthur has developed a model to show how chance events work to select one equilibrium point from the many that are possible in random processes.[12]

Adaptive Systems

Professor John Holland's work on the global economy as an adaptive process is based on what the Santa Fe Institute calls "complex adaptive systems".

Complex adaptive systems are systems in which many "agents" are acting in parallel and the environment in which they operate is influenced by the way in which they react to each other. As a result, nothing in the environment is fixed.

The control of the system tends to be highly dispersed - for example, there is no master neurone in the brain, nor is there a master cell within a developing embryo.

Coherent behaviour in the system arises from collaboration and competition between the agents themselves. The system has many levels of organisation with agents at one level serving as the building blocks for agents at a higher level[1]. The system is constantly revising and rearranging its building blocks as it gains experience.

Complex adaptive systems anticipate the future but this business of anticipation and prediction is encoded into the system in terms of "If .... then .... rules"[2].

Finally, complex adaptive systems typically have many niches, each one of which can be exploited by an agent adapted to fill the niche; and the very act of filling a niche creates other niches[3]. Thus, new opportunities are always created by the system.

Overall, the system is always in transition and the only time it is in equilibrium is when it dies. Since the space of possibilities is so vast, agents can never optimise their fitness or utility. All they can do is change and improve themselves relative to what other agents are doing. As a result, complex adaptive systems are characterised by "perpetual novelty"[13]. Many of these ideas have been validated using neural networks and genetic algorithms.

An insight that John Holland had in the early 1970s was that an adaptive agent is constantly playing a game of prediction based on feedback with its environment.

Ordinarily, prediction is based on an explicit "mental model"[4] of the world. These mental models might include a business plan, an economic projection or a computer experiment. Many psychologists are convinced that mental models are the basis of all conscious thought.

However, Holland felt the concept of prediction and models ran far deeper than this. All complex systems - whether they are economies, minds, or organisms - build models that allow them to anticipate the world. Thus a key problem he faced was to determine where these models came from.

1 This has interesting parallels with "The Principal Of Subsidiarity".
2 In a business context, this has interesting parallels with Schein's view of culture.
3 Peters and Waterman were fascinated by the concept of nichemanship citing 3M, Digital, and HP as examples. See In Search Of Excellence pages 182-186.
4 The concept of mental models is also addressed in Senge pages 174-204.

Since many of the models are not conscious, for example a nutrient-seeking bacterium, they cannot come from a master programmer. Therefore he concluded that they must come from feedback from the environment. The truth of this assertion was proved by the development of classifier systems.

The underlying principles of these systems is that knowledge can be expressed in terms of mental structures that behave very much like rules, that these rules are in competition, so that experience causes useful rules to grow stronger and unhelpful rules to grow weaker and that plausible new rules are generated from combinations of old rules.

Artificial Life

In The Theory Of Self Reproducing Automata, John von Neumann[1] considered whether a machine could be programmed to make a copy of itself.

His conclusion was that for this to happen, the genetic material of any self-reproducing system - whether natural or artificial - would have to play two different roles. It would have to serve as a programme that could be executed during the construction of the offspring and it would have to be able to provide a description that could be copied and given to the offspring. This was subsequently proved by the discovery that DNA fulfilled von Neumann's two requirements precisely.

It can be shown that self-reproduction by machines is possible through the use of a cellular automaton. The cellular automaton, which was conceived by Stanislas Ulam, is a programmable universe in which time is represented by a clock and space by a lattice of cells containing an "automaton". Each automaton can only be in one of a finite number of states - such as red, white, or blue or 1,2,3,4 or living and dead. At each tick of the clock, the automaton makes a transition to a new state. This is determined by its own current state and the current state of its neighbours. Thus the laws of this von Neumann universe can be defined in its "state transition table" - the rule book which tells each automaton how to change its state for each possible configuration of states in its neighbourhood[14].

[1] John von Neumann was born in Budapest in 1903. A maths prodigy, he was awarded his Ph. D. at the age of 22. At 23, he was the youngest person to lecture at the University of Berlin. Aged thirty, he was appointed one of the first professors at the Institute of Advanced Study in Princeton, New Jersey along with Albert Einstein. He was the architect of the digital computer, developed game theory, led the seminal development of the theory of automata and played a major role in the development of the atomic bomb. He died of cancer in 1957.

One of the highlights that John von Neumann used to prove his theory of self-reproducing automata was to show that there was at least one very large and complex cellular automaton programme that could reproduce itself.

The goal that Chris Langton set himself, initially, was to find a simpler self-reproducing system that would fit within the memory constraints of an Apple II computer[15] In two months, he created the simplest self-reproducing cellular automaton ever discovered.

Cellular automata have deep similarities to non-linear dynamical systems. According to Stephen Wolfram[1], all the rules governing cellular automata fall into one of four universality classes. These classes are:

Class I. This is the doomsday class and contains those rules where the cellular automaton will die in one or two time periods.

Class II. These rules are more lively but not much. With these rules, an initial pattern that scattered live and dead cells on a computer screen at random would quickly coalesce into a set of static blobs.

Class III. This is the "Chaos" class. The system never settles down and it is impossible to make any predictions about its behaviour.

Class IV. The rules in this class produce coherent structures that grow, split apart and recombine in "complex" ways. At the time these rules had no equivalent in dynamical systems and Wolfram's conclusion was that they were unique to cellular automata.

It seemed to Chris Langton that it was these Class IV rules that governed the emergence of life and self-reproduction in his von Neumann universe.

[1] Stephen Wolfram was born in England in 1959 and was educated at Eton and Oxford. By the age of 20, he had received a Ph. D. in theoretical physics from Caltech. His early work on particle physics, cosmology and computer science earned him one of the first MacArthur awards. He made the first of a series of fundamental discoveries about the origins of complexity in 1981.

Langton incorporated an intensity factor into his cellular automaton system. This was the probability that any given automata would be "alive" in the next generation. Varying this intensity factor initially produced Class I and II behaviour. Increasing the factor to a value of 0.5 produced Class III behaviour. What he discovered was that a value of around 0.273 would produce Class IV behaviour[1].

Thus Langton discovered that, right "on the edge of chaos", was a zone where there was a balance between the rules of order and disorder which produced coherent and emergent structures. This can be described in dynamical systems terms as:

Order ⇨ "Complexity" ⇨ Chaos

Richard Pascale proposed that successful companies used fit, split, contention and transcendation to manage on the edge. Chris Langton discovered, not only, the same capabilities in cellular automata, but also, that this depended on an intensity factor that reflected the automata's ability to adapt to its environment.

The issues of chaos, and complexity raises three questions in an organisational context:

- How does the external environment influence an organisation?
- Is control in an organisation organisation widely dispersed as Peters and Waterman inferred? Or, is there a master cell?
- Is "Leadership" an organisation's master cell?

[1] It can be shown that these Class IV transition rules are, in fact, what a physicist would recognise as "second-order phase transitions".

The Formal and Informal Organisation

"The hardest thing for a company is to change it's thinking"

E Artzt, Ex-CEO, Procter & Gamble Inc.

In common with neo-classical economics, much of what is written about organisations appears to be based on the perspective that companies are rational and cohesive entities with a single set of values that can, in some way, be separated from the diverse collection of people who work in them.

Whilst organisations exist at both a formal and informal level, the power and importance of the informal organisation seems to be underestimated. This point was alluded to by Peters and Waterman when they suggested that the McKinsey 7-S Framework(Figure 9) provided managers with a framework for understanding "all that stuff you have been dismissing for so long as the intractable, irrational, intuitive, informal organisation"

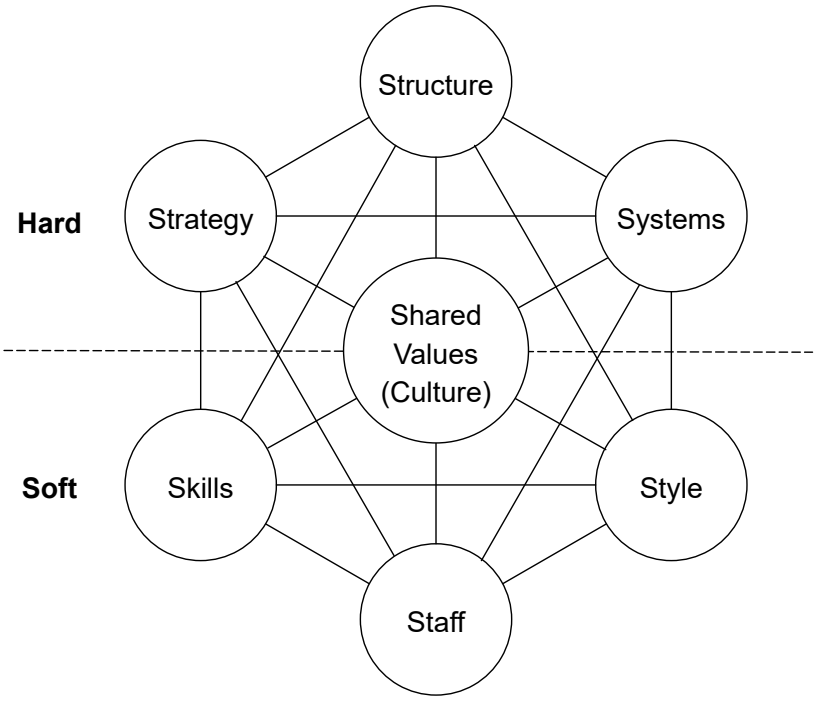

Figure 2: McKinsey 7-S Framework

.

In a study of effective marketing implementation, Bonoma noted that *"in the best organisations, management is able and willing to substitute its own skills for shortcomings in the formal structure"*[16].

Weick[17] takes the view that:

- Organisations are complex feedback systems. This starts at the fundamental level of communication between two or more people within the organisation.
- The systematic feedback structure of the organisation itself determines its behaviour over time rather than external environmental forces.
- A group of people do not necessarily have to have a shared common purpose in order to be a group. People form groups before they have a common purpose because they have interdependent needs that require the resources of others. Thus, an organisation is not necessarily driven by goal-seeking behaviour.
- Organisations create and invent their own environment in the sense that the environment is their perception of what is happening, and in the sense that their actions impact on the environment which then impacts back on the organisation.

  This has much in common with the "moments of truth" concept. This concept was originated by Jan Carlson when he ran Scandinavian Airline System (SAS). Carlson discovered that SAS's reputation rested not so much on the products provided, safety, schedules and so on, but on the millions of verbal encounters between airline staff and passengers[18].
- People do not necessarily have to have a shared common purpose in order to be a group.

  People form groups before they have a common purpose because they have interdependent needs that require the resources of others. Thus, an organisation is not necessarily driven by goal seeking behaviour.
- Predicting what complex feedback systems will do is very difficult. It is difficult to guess what people's preferences will be in the future and it is these preferences that will determine what they do.
- Despite this unpredictability and complexity, people can operate as part of a system that is too complex for any one person alone to understand. Each plays a

part in the complex unfolding of events, understanding only a part, and relies on others to play their parts.

- ❖ Such systems are essentially self-designing.
- ❖ Positive feedback and self-reinforcing processes play a very important part in organisations. Attempting to control them with negative feedback alone may lead to unintended positive loops and unintended consequences.

Many of Weick's ideas have parallels with Hebb's seminal thinking on the functioning of the brain and nervous system which he published in *The Organisation of Behaviour* in 1949. This is also the basis of today's neural network computer programs.

Hebb's fundamental idea was that the brain was continuously making changes to the points where nerve impulses jump from one cell to the next. These are known as "synapses". Any external impulse would leave a trace on the neural network by strengthening all the synapses that lay along its path. As a result, a network that started out at random would rapidly organise itself. Experience would accumulate through a kind of positive feedback. Frequently used synapses would grow stronger, while those synapses that were not used would become weaker and atrophy.

This selective strengthening of the synapses would also cause the brain to organise itself into "cell assemblies". Hebb considered these assemblies to be the basic building block of information. However, they would not be distinct and would overlap with other cell assemblies. As a result activating one assembly would, in turn, activate others which would lead to larger assemblies and concepts, and more complex behaviours[19].

The Informal Organisation

It has been suggested that when people work together they form a social group whose aims may or may not be the same as those of the formal organisation. This informal, or network, organisation can often exert sanctions which can be more powerful than those of the formal organisation. It has also been suggested that these groups are the fundamental social architecture of the organisation and are the means by which managers communicate and shape the organisation.

The formal organisation is primarily concerned with what Stacey, adopting the terminology used by Kuhn to distinguish between ordinary and extraordinary science, has

termed “ordinary management”. In this, the organisation formulates and executes a strategy to achieve a set of objectives. Since the formal organisation is the guardian of the status-quo, difficulties in executing this strategy are likely to be accompanied by a relatively mild desire to modify the system. This is analogous to applying negative feedback to bring the organisation back into equilibrium.

Sir John Harvey-Jones has concluded that:

”People are more realistic than managers give them credit for. After all, it is they who suffer most from the effects of bad management ..... In the overwhelming majority of cases your people are expecting change - and complaining about the lack of it - long before the managers act. In practically every pub or bar used by the staff in a large organisation the gossip is almost always about what is wrong, and what could be improved - and people are surprisingly honest with themselves”[20].

Thus, it seems reasonable to assume that the activities of this formal management system are analysed continuously by the network organisation. This will be done in three ways, by what managers say, do and measure. Almost inevitably this analysis will identify anomalies or “mixed messages”. Rationalisation of these anomalies will act as self-reinforcing or positive feedback to the organisation’s culture. Where, however, the anomalies are perceived to be contradictory, or, not in the interests of the informal organisation, it is likely that the informal organisation will seek to change the organisation either overtly or covertly. This is illustrated in Figure 3.

Japanese colleagues will recognise the parallels between the formal and informal organisation, *tatemae* and *honne*; and *sake-no-ue*. For other readers, *tatemae* may be viewed as the formal principles that provide a group’s harmony, whilst *honne* is the private opinions of the individual. *Sake-no-ue* means “over sake” and is an opportunity for an employee to speak his mind to his manager in the evening over a few drinks. Harmony and balance, based on respect, can be restored the next day by the employee apologising to his manager for any offence he may have caused and blaming it on the sake.

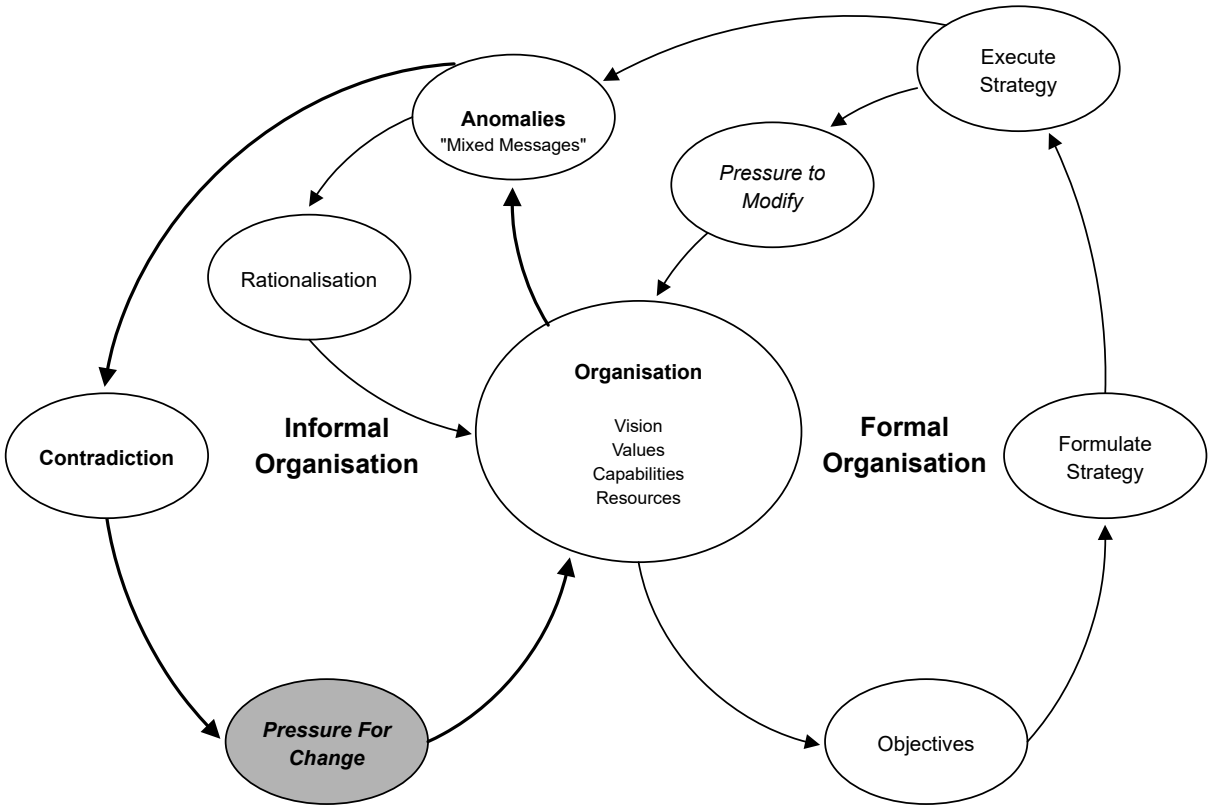

Figure 3: The Pressure for Change

Applying Hebb's model to an organisation suggests that, initially, the main connections in the organisation are those described by its formal organisation. At the same time there are other "informal" connections. Over time connections which are used become stronger, whilst those that are not used become weaker. Thus, the organisation organises itself into formal and informal "sub assemblies". These "sub assemblies" govern how the organisation learns.

An adaptation of the Johari window may be used to identify areas where conflict can arise between these formal and informal sub-assemblies, its effects and how these may be reduced.

The Johari window was conceived by Joseph Luft and Harry Ingham as a means of analysing the interaction between people based on their behaviour and is illustrated in Figure 4.

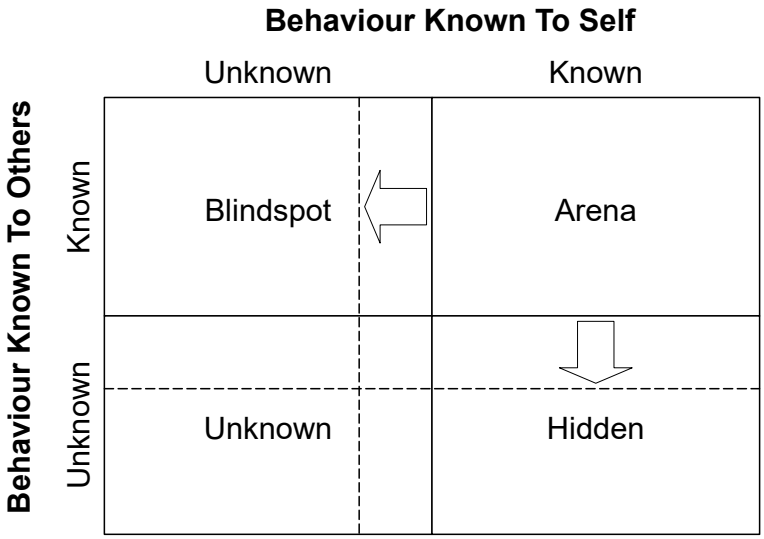

Figure 4: The Johari Window

The model suggests that the "Arena", where effective communication takes place, is determined by each person being aware of the other's behaviour. However, it may be that other people interpret an individual's behaviour in a different way than they do, in which case the individual has a "Blindspot" Alternatively, an individual may know things that he is not prepared to share with others in which case the behaviour is "Hidden". Finally there is the "Unknown" where something is unknown to both parties. The respective dimensions of the four quadrants may be changed through more effective communication and, in particular, by asking open ended questions.

Applying this to an organisational context produces the window shown in Figure 5.

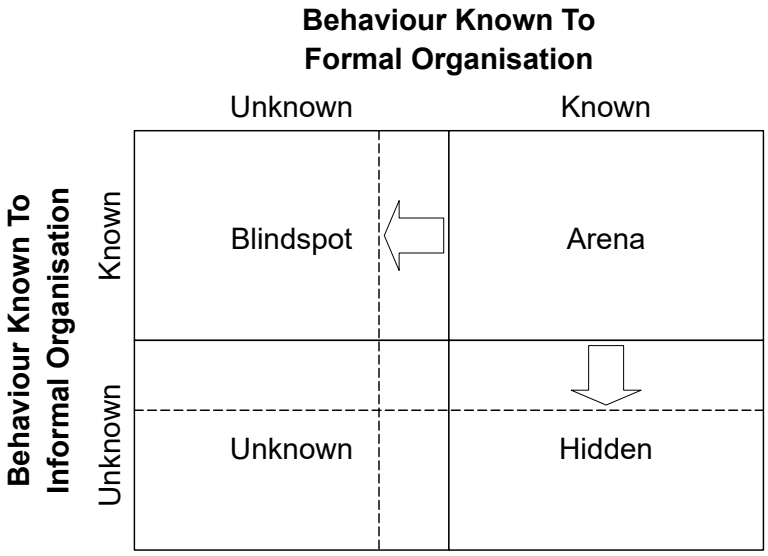

Figure 5: The Johari Window and Organisations

Managing Change

A survey conducted by Vandermerwe and Vandermerwe among top-level executives suggested that the commonest obstacle to change was the 'fear' factor and human resistance[21]. Other authors have suggested that the greatest obstacle to change is the notion that it can be produced by company-wide change programmes and have suggested that the most effective managers of change recognise their limited ability to mandate change and confine their role to creating a climate in which change can take place.

An adaptation of the Johari window incorporating a systems perspective of the organisation shows why this might be the case. The model is shown in Figure 6.

The model suggests that the formal organisation's view of reality is determined by its interpretation of the external environment which, in this case, represents the conditions influencing development or growth, and shareholders' expectations. Various processes are used to filter the messages coming from these sources into issues that are regarded as "Important" and "Not Important". This, then, provides direction to the organisation.

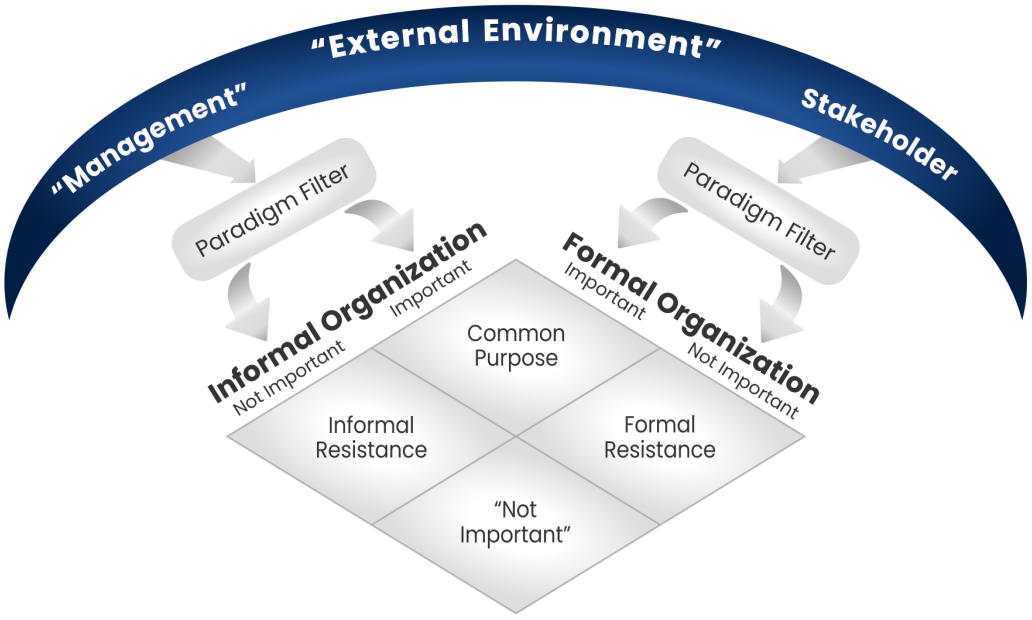

Figure 6: Creating a Common Purpose

The informal organisation takes its cues from more senior management. However, it also has views, albeit different from the formal organisation, on the external environment. It, too, filters messages into those that it regards as "Important" and "Not Important".

It is apparent that those issues that the formal and informal parts of the organisation regard as important provide the organisation with a common purpose and contribute to the development of the organisation's culture.

Those issues which are regarded by the formal organisation as "Not Important" but by the informal organisation as "Important" might be viewed as the organisation's "Blindspot". Whether the informal organisation's view of what is important is valid or not, it seems likely that the informal organisation will try to change the organisation so that its concerns are acknowledged. This is likely to encounter management resistance; often in the form of not acknowledging the issue or by introducing systems to control it. As Argyris has shown, this type of mechanism led to the Challenger space shuttle disaster.

Those issues which are regarded by the formal organisation as “Important” but by the informal organisation as “Not Important” are, in effect, hidden from the rest of the organisation. It seems likely that whilst management will expend significant energy in trying to change the organisation to reflect these new realities, this will be accompanied by resistance on the part of the informal organisation.

Finally, there may be issues which both parts of the organisation regard as being “Not Important”. This area is potentially a source of opportunities and, more importantly, threats.

The model, therefore, identifies a number of factors which appear to be important in understanding the dynamics of change. This is illustrated as a cusp catastrophe in Figure 7.

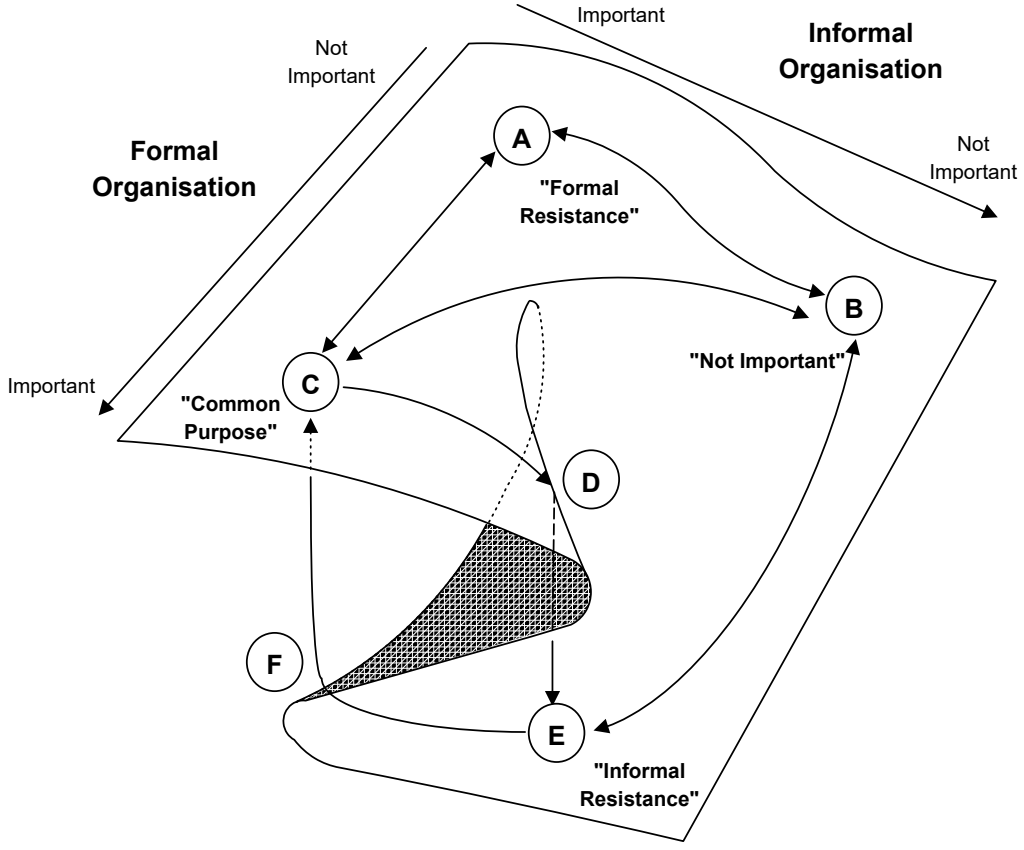

Figure 7: Change as a Cusp Catastrophe

Perhaps the most important of these is the creation of a common purpose for the organisation. This implies that the organisation has a vision[1] that ordinary people can buy into, that managers have a clear understanding of their role and responsibilities as managers and that they understand the concerns of the people in the organisation. This seems to imply something to do with "leadership".

Catastrophe Theory

Catastrophe theory, which derives its name from the "ultraviolet catastrophe" in classical physics, is a way of thinking about discontinuous change.

The theory is based on topology which has been called "rubber sheet" geometry. Instead of the straight lines, restricted curves and the regular solids of Greek geometry, topology deals with all conceivable forms. The theory is well suited to describe and even to predict the shape of processes. However, because of its foundations, these descriptions are qualitative and not quantitative. They have been likened to "maps without a scale".

The theory was developed by René Thom, an acknowledged master of differential topology, between 1965 and 1972.

The elementary catastrophes are the seven simplest ways for a discontinuous change to occur. They can be illustrated by topological models which show stable states as lines or surfaces in a 'behaviour space'. As long as a system occupies one of these points, its behaviour is continuous. However, when it leaves the line or surface it is unstable and must return - sometimes at a point that is far distant from the initial point.

The "cusp" catastrophe occurs in systems whose behaviour depends on two control factors. The model, which is shown in Figure 8, is a three dimensional curved surface with a pleat.

[1] See, for example, "Building Your Company's Vision", Collins J C and Porras J I, Harvard Business Review, September-October 1996, pages 65-77.

Every point on the surface represents an equilibrium state. All the points on the underside of the pleat are unstable maxima. All the points along the fold line, which forms the lip of the pleat are semi-stable turning points. All the rest of the points are stable minima. There are two possible states for certain combinations of values of the control factors, one on the upper surface of the pleat and one on the lower surface. The behaviour of the system under these conditions is known as “bimodality”. This means that the same conditions permit either of two stable states.

As conditions change over time, the system’s behaviour changes. All smooth changes can be visualised as points moving along the surface. However, the cusp catastrophe allows for discontinuous change when a point moving to the left or right reaches the lip of the pleat.

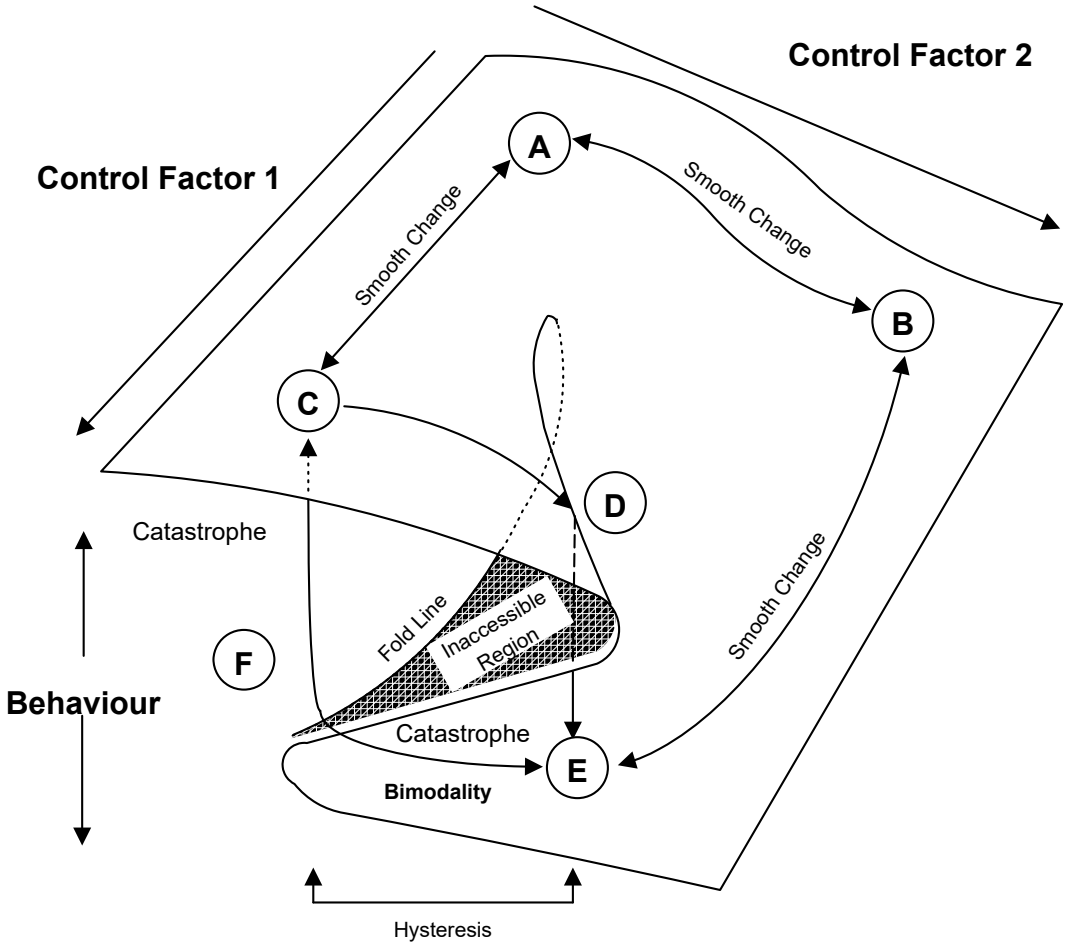

Figure 8: The "Cusp" Catastrophe

The system can pass smoothly from **A** to **C** and back; from **A** to **B** and back; and **B** to **E** and back.

However, if the system is at point **C** and Control Factor 2 is changed so that the system reaches point **D**, there is nowhere left for it to go. What was a stable point has become a turning point. Any further change in Control Factor 2 requires the system to jump to the only stable point left, the one at **E**. It passes as quickly as possible through the non-equilibrium state. This transition is a catastrophe.

A similar jump occurs if a system at **E** is altered by a change in Control Factor 2. It moves to **F** and then has to jump catastrophically to **C**.

If the system is at point **C** and Control Factor 2 alternately increases and decreases by a suitable amount, the result is a cycle of behaviour with two smooth portions linked by catastrophes. Such a cycle is called hysteresis.

The Controversy

Since its development, catastrophe theory has attracted a degree of controversy. This is based on four arguments[22]:

- The theory's foundations in mathematics and natural philosophy. An objection here is that catastrophe theory is not the first or best way to approach discontinuous change.
- The assumptions needed to apply it.

  Two assumptions are required. The first is that the system is governed by potential.

  Pierre Simon, Marquis de Laplace (1749-1827), was a French mathematician and philosopher who is best known for his successful application of Newton's theory of gravitation to account for all planetary motion in the solar system. In his work on gravitation, Laplace developed a convenient mathematical shortcut to represent the action of gravitational force. This was the potential - a concept that summed up all the forces acting on an object in a single value. It has become customary to view many systems as being governed by a tendency to seek a point that minimises their potential energy.

  Psychologists and economists would find it impossible to theorise without assuming there are drives, whether instinctive or learned, that individuals and groups seek to satisfy. Economic theories are based on maxima and minima in relation to costs, production utility etc.

  The most far-reaching theory in biology, that of evolution, is built around an implicit potential. This is that evolutionary success is determined by an organism's ability to maximise its reproduction in a given environment.

The second assumption is that the behaviour of a system relies on a limited number of control factors.

- The details of specific applications.

  It is the reader who must judge whether the use of catastrophe theory in the context of this paper agrees with their own experience.

  Many of the cusp catastrophes can be represented as matrices.

  However, many matrices display discontinuous behaviour. To the non-mathematician, one of the great beauties of catastrophe theory is that overlaying the elements of divergence, catastrophic jumps, smooth or sudden passages between the same initial states and final states, and hysteresis enables the power of qualitative models such as a matrix to be visualised and enhanced.

- The attitudes of the theory's advocates and opponents

  The main criticism was that catastrophe theory was attracting attention from pure mathematicians who wanted to do something useful "without knowing anything about mathematics"[23].

Leadership

"Let me digress for a moment and say how I handled men in the army at all times and particularly in war-time in the Eighth Army and in 21 Group. I made the soldiers partners with me in the task which lay ahead. I took them into my confidence, explained the problem and how we would solve it, told them what they had to do and how success or failure on their part would affect the master plan, and finally told them how the job would be done - and when. In war, the soldiers then won the battles; I didn't. And when we weren't fighting, I saw to it that they had every possible amenity in the way of good meals, newspapers, mail from home, concert parties, leave and so on. In peace-time the men's wives were visited by the officer's wives and their families were looked after in times of need. All this produces a comradeship between officer and man, between a general and his troops and the comradeship of the army is a great and wonderful thing - as I know well. But of course it is not so easy in industry. ..... The essence of an army is discipline, whereas the essence of democracy is freedom; soldiers have to obey orders, workers have to be persuaded." [24]

Field-Marshal, The Viscount Montgomery of Alamein KG GCB DSO.[1]

"I like to talk in terms of the challenge of leadership. I define the challenge of leadership as the ability to get people - underline that; that's very important -because leadership is about leading people - to willingly, underline that word willingly, do that which they ordinarily would not do. ..... We are indeed asking people to do the very thing that all of us in the crib know instinctively not to do and that's risk our lives." [25]

General H Norman Schwarzkopf.[2]

1 Field Marshal Montgomery (1887–1976) was a British military leader who played a prominent role in the Allied victories in Africa and Europe during World War II.

2 General Schwarzkopf was Commander-in-Chief of the Allied Coalition Forces in the Gulf War, 1990-91.

"The thing I remember most remember about Frank Whittle [1] *at that time was his total absorption in what he was doing – a total concentration which impinged itself on the very atmosphere surrounding him. It was very hard for anybody to evaluate him because he was a many-ssided person who had a charming naivete. He trusted people, and believed everybody was motivated by the common good. I had the utmost respect for him as a leader and, of course, for his genius"* [26]

R G Voysey.

All of us in our time have met a leader. Put simply, we have felt better for having met them. On rare occasions we may have felt inspired. These people appear to have a rare gift - they make us feel good about ourselves. They are tolerant, almost indulgent, towards us [2]

If we have met this leader in a business situation we are likely to feel:

- Confident
- Clear on what has to be done and our role
- Determined to help achieve the objective

Much has been made of the Japanese habit of making decisions through consensus and participation. It seems likely that, in many situations, it is the only way they can make decisions. However, it has the great benefit that the three goals described above are achieved.

Compare, and contrast this, with meeting somebody who wants us to feel good about them - even if this is only in a spirit of sycophancy. Their modus operandi seems to be "when the going gets tough, the tough get going", our achievements become their achievements and our ideas are either ignored or become theirs. The more we please, the more we have to please. In many instances it is not sufficient that they should win, we also have to lose.

1 Sir Frank Whittle OM KBE CB (1907-1996) invented the jet engine

2 Japanese colleagues will probably recognise the relationship between this and amae. This has been used by Takeo Doi, a Japanese psychiatrist, to explain why only a mentality rooted in amae can explain why the Japanese can be simultaneously so "unrealistic and clear-sighted as to the human condition; so compassionate and so self centred; so spiritual and so materialistic; so forbearing and so wilful; so docile and so violent - a people, in short, that from its (sic) own point of view is pre-eminently normal and human in every respect". This is addressed in more detail in The Anatomy Of Dependence.

If we encounter these people in a business situation, we are likely to feel:

- Apprehensive.
- Confused, fearful and, possibly, angry about our role.
- Indifferent to the objective.

Montgomery defined leadership as "the capacity and will to rally men and women to a common purpose, and the character which will inspire confidence". [27]. He suggested that leaders:

- Are motivated by an inward conviction which appeals to their followers. In other words, leaders have visions.
- Have a deep, great and genuine sincerity.
- Are selfless and have an absolute devotion to the cause they serve.
- Have an ability to dominate, and finally to master, the events which encompass them; and that a failure in this area leads to a loss of confidence.
- Are decisive.
- Are good at picking people.
- Must have a genuine interest in, and a real knowledge of, humanity.
- Will "throw their bonnet over the moon" in situations which favour boldness having done everything possible in the way of preparation.

Interestingly, this also provides an excellent description of successful Japanese leaders such as Soichiro Honda and Takeo Fujisawa, the co-founders of Honda Motor [28] ; Akio Morita, the founder of Sony [29] ; Konosuke Matsushita [30] ; and Kazuo Inamori, Chairman of Kyocera and DDI Corporation [31].

The Winning Streak, *In Search of Excellence* and *Managing on the Edge* noted that leadership was important. However, their interpretation of its role and importance differed.

This may have been a reflection of different cultural biases and, in particular, the American predilection to seek a universal set of rules based on the primacy of analysis [32] . For example, Montgomery was of the view that leaders are made. Drucker, on the other hand, whilst noting that "*the manager was the dynamic and life-giving element in every*

business and that without his leadership the resources of production remain resources rather than production; ultimately concluded that leadership could not be created or promoted, taught or learned"[33].

Leadership

The importance of leadership was recognised early in the research. Whilst Peters and Waterman expressed a preference to discount the role of leadership heavily based on a strong belief that the excellent companies had to be the way they were because they possessed a unique set of cultural attributes that distinguished them from the rest. What they actually found was that a strong leader (or two) was associated with almost all the excellent companies. One of their conclusions was that the excellent companies had developed cultures that incorporated the values and practices of great leaders with the result that their shared values survived for decades after the passing of the original leader(s)[34].

In this they appear to be both seeking a universal rule and describing what Walter Lippman has suggested is the final test of a leader: "*he leaves behind him in other men the conviction and will to carry on*".

The Winning Streak

In The Winning Streak it was noted that leaders were visible and that communications were of critical importance. The leaders of the companies provided a clear mission which they believed in passionately and which they invited others to subscribe to. By contrast, in the unsuccessful companies studied, there was frequently massive confusion about top management's long term objectives. The importance of integrity and the influence of the family founder were also noted.

Finally it was noted that, in a survey based on 5000 employees at General Motors which was followed-up by a similar survey at AT&T, Dr Richard Ruch found the tasks employees associated with top management were[35]:

- Informing employees ahead of time about changes that affected their jobs.
- Caring about how employees felt about their work, and being open and honest in dealing with employees.

- Giving serious consideration to employee suggestions.
- Giving supervisors enough authority to get the job done.
- Making a strong commitment to serving the customer.
- Having the ability to solve major company problems.
- Running a socially responsible organisation.
- Providing the new services and products required to meet competition.
- Placing more emphasis on the quality, rather than the quantity, of work.

Managing on the Edge

Pascale:

- Identified three different forms of leadership - managerial, transformational and charismatic.
- Concluded transformational and managerial leadership were not mutually exclusive.
- Concluded it was doubtful whether charismatic leadership could, in itself, secure a genuine transformation.

He defined managerial leadership as an administrative orientation whose aim was to get the maximum out of the existing organisation. Transformational leadership was viewed as a style of leadership that was required to obtain quantum leaps of performance in an organisation.

Andy Grove, co-founder and CEO of Intel, was used to illustrate the managerial end of the leadership continuum. Pascale noted that Grove's strengths included a first-rate mind, the ability to get to the heart of a problem, and that Groves had a masterful grasp of both strategy and tactics.

He questioned whether people could both "lead and manage". He concluded that some, such as Thomas Watson Jr and Konosuke Matsushita, could. But, in other cases, it might be more appropriate to use a pair of opposites in the form of a CEO and a COO such as at Ford, Hewlett-Packard, Honda, Sun Microsystems and Sainsbury. He also noted the dangers of pairing similar people.

It is a moot point whether the "Vectors of Contention" in which he mapped the structured domains where internal conflicts emerge to McKinsey's 7-S framework (Figure 9) actually exist in the form described[36] - or whether this was an elegant piece of post-hoc rationalisation.

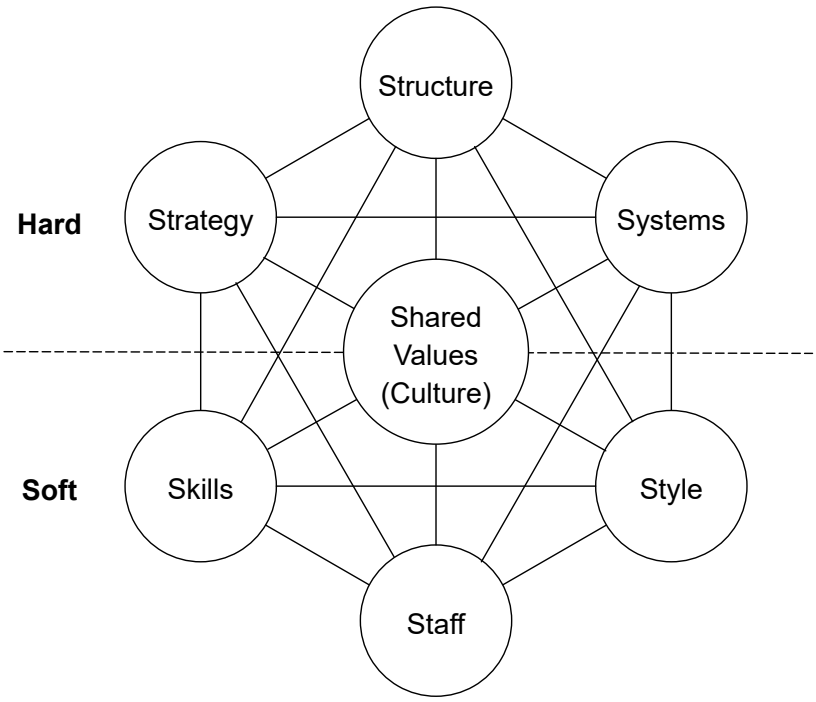

Figure 9: McKinsey 7-S Framework

More likely, constructive tension is created, either, by the trade-offs that have to be made to maintain the positive commitment of stakeholders, or, by the pairing of two opposites in positions of leadership.

Big Blues - The Unmaking Of IBM

An interesting example of this is the history of IBM up until the resignation of John Akers in 1993[37].

The leadership of Thomas Watson Jr, who was chairman of IBM until 1970, was balanced by Frank Cary - *"when Watson used to blow, Cary was almost the only one who dared to stand up to him"*[38].

Frank Cary was chairman of IBM from 1972-1980. Cary surrounded himself: *"with people who would tell him what was really going on and weren't afraid to confront him if they*

thought some major project was taking the wrong approach with its technology"[39]. It was Cary who both financed and created the environment in which IBM developed the PC.

John Opel, who has been described as: *"so low on the charisma scale he barely registered"*[40], succeeded Frank Cary. During his tenure, IBMers were encouraged to win arguments without offending colleagues, the company became risk averse and indulged in financial engineering on a grand scale. This resulted in record, but unsustainable, earnings in 1984.

John Akers, who took over from Opel in 1985, was described at the time as a "natural leader". Sadly, by this time, the environment was no longer predictable and IBM was no longer open to and connected with it. Akers could not engineer the required transformation. By 1991, Akers put in place: *"a series of events that would cost him the support of most of his senior managers and just about everyone lower down the company"*[41]. This culminated in the demotion and subsequent resignation of George Conrades - a great leader who was *"also unusual because he stood up to Akers"*[42]. John Akers resigned in March 1993.

Donald Petersen, who at the time was President of Ford Motor company, was chosen to exemplify transformational leadership. Pascale described Petersen's approach as low-key and low-profile and that, Petersen viewed the role of an executive as a "prodder, facilitator and catalyst".

Lee Iacocca was used to illustrate charismatic leadership. Pascale's conclusions were that charismatic leadership had more to do with the power of the leader's personality and that a distinction needed to be drawn between a financial turnaround and a genuine organisational transformation. His conclusion was that, at the time, Chrysler was only incrementally better than in its pre-incarnation crisis.

Points Arising

It is interesting to note that, as far as one can tell, all the leaders referred to in In Search of Excellence, The Winning Streak and Managing on the Edge - with one possible exception - display virtually all the leadership attributes described by Montgomery.

A common characteristic of all the successful companies seems to have been that they had a large number of leaders, together with leadership in depth. For example, Peters and Waterman's product champions were clearly motivated by a deep inner conviction which they pursued with devotion. They had followers. They had the ability to master the events that surrounded them.

Professor J Arthur Thomson has noted that: *"the most powerful factors in the world are clear ideas in the minds of energetic people of goodwill"*. Perhaps the most striking attribute of leaders is the way this is expressed through their humanity.

Montgomery noted that the leader:

"must understand that bottled-up in men[1] *are great emotional forces and these must have an outlet in a way which is positive and constructive, and which will warm their hearts and excite their imagination. If this can be done, and the forces can be harnessed and directed towards a common purpose, the greatest achievements become possible. But if the approach to this human problem is cold and impersonal, little can be achieved*.

On assuming his first command, Lieutenant de la Billière, noted of his relationship with his soldiers that: *"Provided I looked after their interests, and arranged minor improvements for them, I could be pretty tough on them - and in fact they almost preferred that I should be. I put much time and effort into taking an interest in the people under my command and made sure that they got the best of everything my efforts could provide - and I did this throughout my career"*[43].

This theme recurred in his recollections of John Woodhouse, an SAS[2] officer, who was described as a: *"deceptively quiet and unassuming person.... who always drove himself to his limits, put the welfare of his men before his own, and expected the highest standards from everyone"*[44].

1 Authors note: I'm sure these days women would have been included
2 The UK equivalent of the US Delta Force

Rebuking one of his subordinates, Woodhouse wrote: *"…. in the SAS you will never get the devoted support of your troops until you have proved to them by your personal example that you will never spare yourself physically or in any other way. Next, it is your duty (which should also be your natural wish) to do the best possible for your men…. You will never succeed unless you like soldiers"*[45].

On 6 October 1990, General Sir Peter de la Billière assumed overall command of the British forces in the Gulf War.

It seems that more people have elements of the leader about them than might, at first, be appreciated.

In terms of its human dimensions, leadership may be a special case of the interpersonal classification system developed by Freedman et al[46]. This simple model is shown in Figure 10. Of potentially more interest and explanatory power is to view this matrix as a cusp catastrophe as shown in Figure 11.

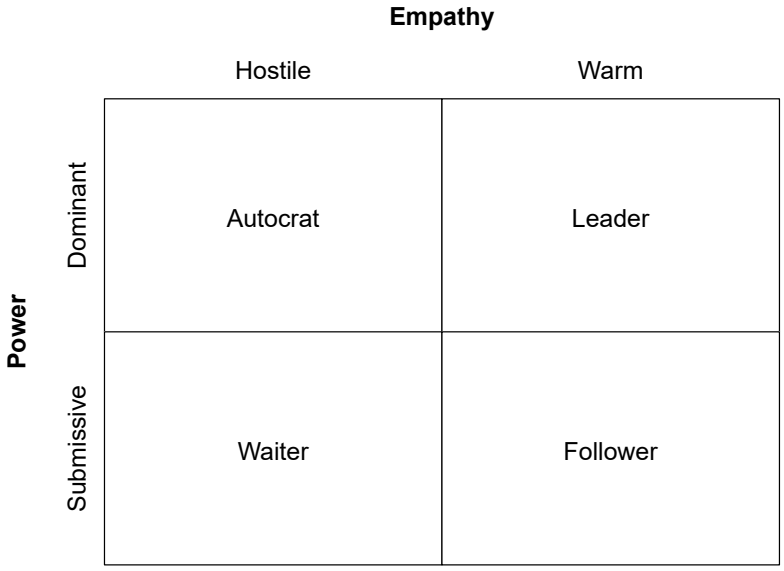

Figure 10: Leadership Power–Empathy Matrix

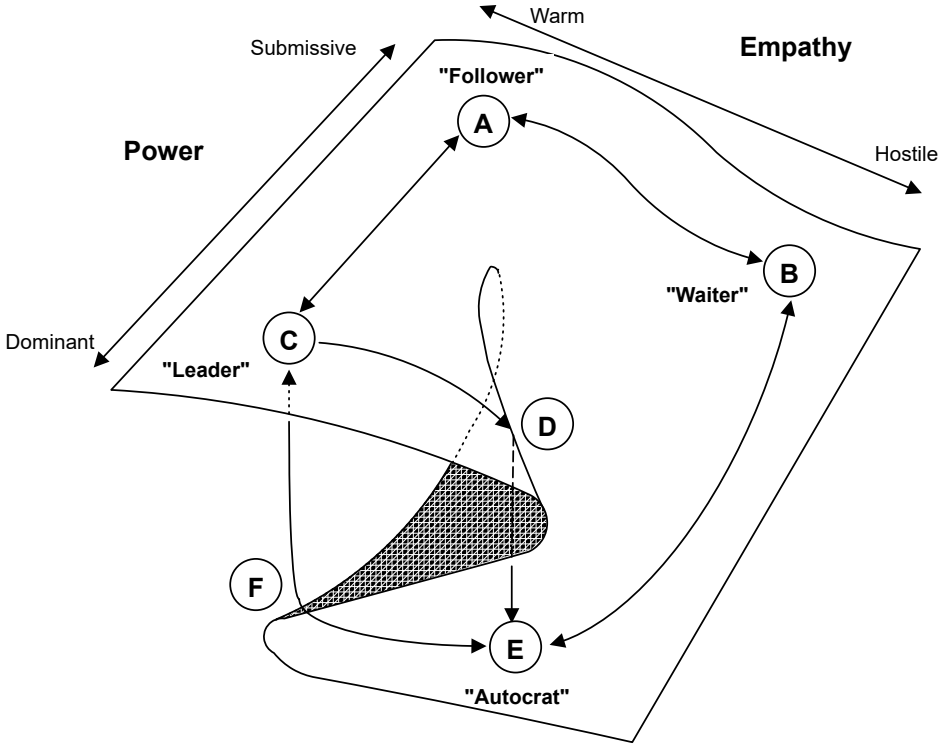

Figure 11: Leadership Power–Empathy as a Catastrophe

What this suggests is that leaders are dominant and empathetic people who use positive feedback to gain commitment and build confidence. They thereby enable ordinary people to do extraordinary things. Concomitantly they can be exceptionally decisive, to the point of ruthlessness, if the integrity of the organisation is threatened.

However, they need to be controlled by powerful, but constructive, negative feedback. If, for whatever reason, leaders lose this feedback and start to believe in their own infallibility, then they can easily become dangerously autocratic.

An overall consequence of good leadership is that the organisation will tend to develop an “extrovert” personality.

The performance of extrovert and introvert companies has been studied by Professor Cuno Pümpin. He has shown that introverted companies focus on cost cutting or technological goals, whereas extrovert companies focus on marketing, customer satisfaction and service. Extrovert companies generally perform better in profit terms.

Appendix 1. Logistic growth models

Consider an organisation of, say, 100 people one of whom has some news. At the start, if one person knows, 99 do not. Now, unless they have a megaphone or some other powerful means of communication they are unlikely to tell the other 99 simultaneously. Even if a notice was put up, some people might not read it or find the news sufficiently interesting to pass it on to anybody else.

Thus, in order to understand how news travels, a factor is required to describe how interesting the news is and therefore how quickly it will spread. It may be recalled that one of the things that intrigued Peters and Waterman was what they described as the intensity with which their excellent companies did things. Therefore this factor might be termed an "intensity" factor. This can be expressed mathematically in the following way:

The spread of news at any moment in time equals:

The number of people who have already heard (pt). + The number of people who have already heard (pt). * The number of people who have not heard. This is equal to 100 minus the people who have already heard. (100-pt). * The intensity factor (k)

A shorthand way of expressing this is:

$$p_{t+1} = p_t + p_t * (100 - p_t) * k$$

The results for different values of k are shown in Figure 12

From this it can been that the the model becomes unstable or unrealistic when k exceeds approximately 2. This behaviour is linked to emerging bifurcations in the system dynamics, driven by:

- Numerical instability - rapid growth causes overshooting and erratic values
- Violation of the bounded range - values of p_t exceed the logical maximum (e.g., more than 100% informed).
- Unrealistic dynamics - the model ceases to reflect interpersonal communication and begins to behave more like instant broadcasting

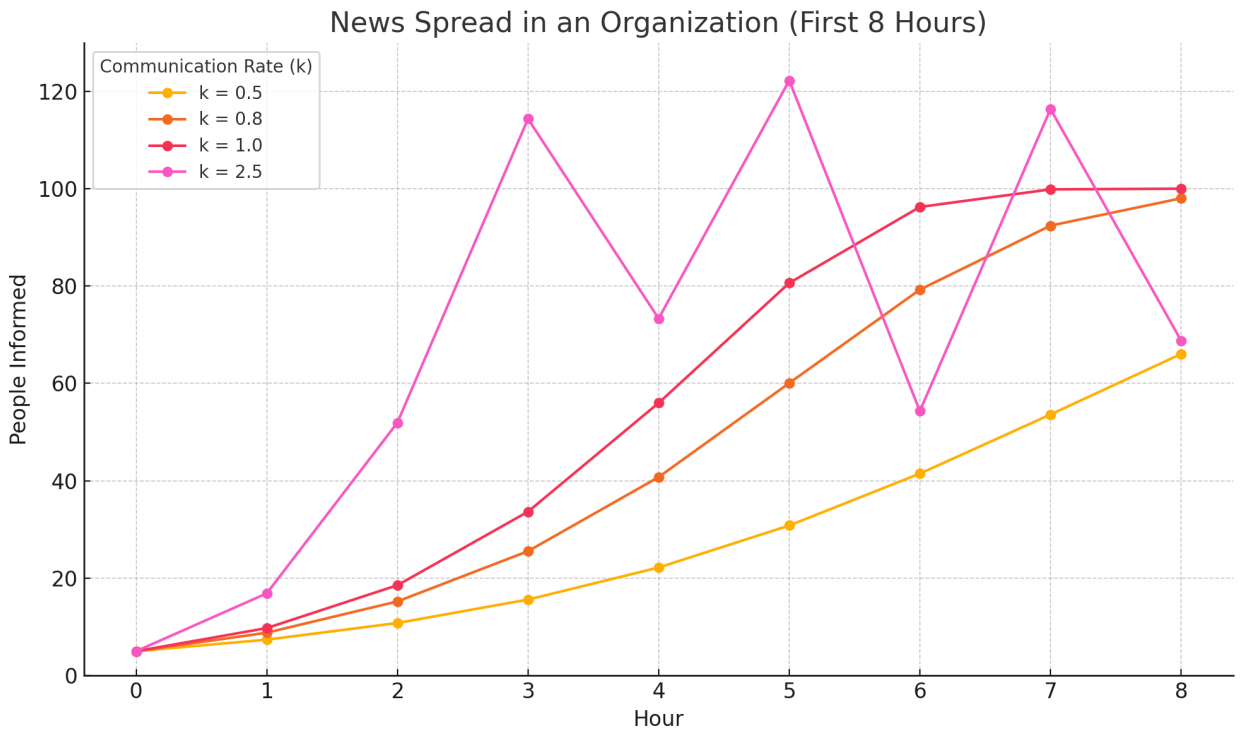

Figure 12: Spread of news for different value of k

Notes

1 Barnard

2 Ansoff and McDonnell

3 Gleick

4 Financial Times

5 Drucker (p 159)

6 Stacey (p 231-239

7 Waldrop (p 138)

8 Waldrop (p 47)

9 Waldrop

10 C. Hampden-Turner and Trompenaars (p 4-6

11 Waldrop (p 13)

12 Waldrop (p 45-46)

13 Waldrop (p 44)

14 Gardner. The Game of Life is an example.

15 Waldrop (p 221-222)

16 Bonoma

17 Stacey (p 166)

18 Hampden-Turner (p 87)

19 Waldrop (p 158)

20 Harvey-Jones (p 29)

21 Vandermerwe, S. and Vandermerwe A. (p 174-180)

22 Woodcock and Davis (p. 69-85)

23 Woodcock and Davis (p. 80)

24 Montgomery (p. 144–145)

25 BBC

26 Golley (p. 130)

27 Montgomery (p. 10)

28 See, for example, Sakiya.

29 See, for example, Morita.

30 See, for example, Matsushita.

31 See, for example, Inamori.

32 C. Hampden-Turner and Trompenaars (p. 19–45).

33 Drucker (p. 13 and 194)

34 Peters and Waterman (p. 26)

35 Goldsmith and Clutterbuck (p. 17)

36 Pascale (chap. 3)

37 *Big Blues - The Unmaking Of IBM*

38 Carroll (p. 55)

39 Carroll (p. 56)

40 Carroll (p. 58)

41 Carroll (p. 265)

42 Carroll (p. 272)

43 De la Billière (p. 57)

44 De la Billière (p. 106)

45 De la Billière (p. 235)

46 Freedman et al.

Bibliography

Ansoff, I and E McDonnell (1990). *Implanting Strategic Management*. Hemel Hempstead: Prentice Hall International (UK) Ltd.

Barnard, Chester I (1968). *The Functions of the Executive*. Harvard University Press.

BBC (1996). *Timewatch*. Television broadcast.

Bonoma, T V (Reprint 84201). "Making your marketing strategy work". In: *Harvard Business Review*.

Carroll, P (1994). *Big Blues - The Unmaking Of IBM*. London: Orion.

De la Billière, P (1995). *Looking For Trouble*. London: Harper Collins.

Drucker, P F (1968). *The Practice Of Management*. London: Pan Books.

– (1990). *The New Realities*. London: Mandarin.

Financial Times (Feb. 1991). "Title of the Article". In: *Financial Times*. Accessed in print.

Freedman, M. B. et al. (1951). *The interpersonal dimension of personality*. Journal of Personality.

Gardner, Martin (Oct. 1970). "Mathematical Games: The fantastic combinations of John Conway's new solitaire game "life"". In: *Scientific American* 223.4, pp. 120–123.

Gleick, J (1987). *Chaos*. London: Cardinal.

Goldsmith, W and D Clutterbuck (1984). *The Winning Streak*. London: Weidenfield Nicolson.

Golley, J (1996). *Genesis Of The Jet*. Shrewsbury: Airlife Publishing.

Hampden-Turner, C (1990). *Corporate Culture*. London: Economist Books / Hutchinson Business Books.

Hampden-Turner, C. and F. Trompenaars (1994). *The Seven Cultures Of Capitalism*. London: Piatkus.

Harvey-Jones, H (1988). *Making it happen: Reflections on Leadership*. HarperCollins.

Inamori, K (1995). *Passion For Success*. New York: McGraw Hill Inc.

Matsushita, K (1988). *Quest For Prosperity*. Tokyo: PHP Insitute Inc.

Montgomery, B L (1961). *The Path to Leadership*. London: Collins.

Morita, A (1988). *Made In Japan*. London: Fontana.

Pascale, R T (1990). *Managing on the Edge*. London: Penguin Books.

Peters, T J. and R H Jr. Waterman (1982). *In Search Of Excellence*. New York: Harper Row.

Sakiya, T (1987). *Honda Motor*. Tokyo: Kodansha International.

Stacey, R D (1993). *Strategic Management And Organisational Dynamics*. London: Pitman Publising.

Vandermerwe, S. and Vandermerwe A. (June 1991). “Making Strategic Change Happen”. In: *European Management Journal*. Accessed in print.

Waldrop, M M (1994). *Complexity*. London: Penguin Books.

Woodcock, A. and M. Davis (1988). *Catastrophe Theory*. London: Penguin Books.