

Management actions, attitudes to change and perceptions of the external environment

A complexity theory approach

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This paper, based on complexity theory principles, suggests relationships between environmental turbulence, managers' perceptions of the external environment, attitudes to change, management actions and business success. Data was collected via a case study method, using in-depth interviews, document analysis and observation from two companies in the computer and packaging industries respectively. Findings reflected a relationship between environmental perceptions and attitudes to change. The more successful firms expected and almost welcomed change, while the less successful companies were victims of change. Overall external environment perceptions, attitudes to change and the resulting management approaches differed between the more successful and less successful companies.

Introduction

Most managers have been brought up in, and trained for, an environment of certainty, whereas they now have to cope with increased complexity, uncertainty and turbulence (McElwee, 1998). Bureaucratic, 'command and control' management is out of touch with the modern environment (Hammer and Champy, 1993). Although mechanistic management may be suitable for stable environments (Morris and Lewis, 1995), it is not effective in conditions of turbulence, where planning cycles are shorter (Wall and Wall, 1995). Traditional managers handle uncertainty by either resisting change or by using prediction to prepare for the future. But in turbulent environments prediction becomes "a matter of guesswork and long odds" (Conner, 1998; p. 41). Some organisations deal with uncertainty by trying to increase stability by focussing on the more predictable short term, by establishing long term contracts, or by postponing the decision. However, Farrell, (1998) believes managers should develop 'schemata', or rules, to make sense of the world,

adapting these schemata as the environment changes. To do this quick adaptation, learning and keeping an open mind are needed (Pumpin, 1991), none of which is possible if top management keeps strategic thinking to themselves.

Management according to complexity theory

Complexity theories are increasingly being adopted as ways of better understanding management in complex/turbulent environments, because businesses and their environments are complex adaptive systems, to which complexity theory can be applied. Before discussing the handling of these environments by the methods suggested by complexity theory, a brief explanation of complexity theory is needed.

Complexity theory

The underlying idea of complexity “is that all things tend to self organise into systems” (Kelly and Allison, 1999; p. 5) when simple rules are applied. These systems can produce unexpected patterns or behaviours (Goldberg and Markoczy, 1998) because of non-linear feedback networks (Stacey, 1996), the interconnection and interdependence of complex systems (Bar-Yam, 2000) and because the system’s parts interact and adapt to each other (Meade and Rabelo, 2004). Complex behaviour is orderly, yet full of surprise; apparently uncontrollable, yet not totally chaotic. The rules that generate this behaviour are not enforced by a ‘manager’, and cannot be predicted from any single part of the system. The system spontaneously self-organises at the edge-of-chaos where there is stability to sustain existence and turbulence to overcome inertia (Waldrop, 1992). Several complexity concepts have relevance to business. The central concept is self-organisation, the process of order emerging from simple rules in a system, which is not controlled by a ‘manager’ (Holbrook, 2003), and which results in creative and innovative responses emerging (Dolan *et al.*, 2003). This emergence, the second important concept, happens when the system’s parameters change, leading to disorder and preventing the system from ossifying. Emergence happens at the edge-of-chaos, enabling new actions to emerge.

The third concept is feedback. Negative feedback inhibits change, pushing the system to equilibrium (Stacey, 1995). Positive feedback amplifies small changes (McGlone and Ramsey, 1998), pushing the system towards chaos (Doherty and Delener, 2001). Together, positive and negative feedback balance the system at the edge-of-chaos, the best position for a turbulent environment (Doherty and Delener, 2001). The fourth concept is sensitive dependence on initial conditions (Briggs and Peat, 1999). In a stable system, small changes have small effects, but in a complex/turbulent system small changes can grow exponentially, making long-term prediction accuracy impossible (Doherty and Delener, 2001; Holbrook, 2003). Small nudges, at the correct time, can thus lead to major changes (Wheatley, 1996). A ‘flywheel

affect' is created, reinforcing early success, and enhancing long-term advantage (Hamel, 2000). Patterns and clues indicate which changes to 'nudge' (Morrison and Quella, 1999), and when to nudge them (Gladwell, 2000). These patterns are known as attractors, the fifth concept. The edge-of-chaos attractor (known as a 'strange attractor') reflects the area where maximum creativity and innovation happens (Lewin, 1992). A unique feature of the strange attractor is that it stays within certain boundaries (Holbrook, 2003). How the system will develop cannot be predicted, but it will not go outside its attractor (Doherty and Delener, 2001). Thus, the strange attractor allows change while maintaining some order (Frederick, 1998).

Application of complexity theory to management

General principles

Whether the environment is stable, predictable within boundaries, or chaotic, a complexity viewpoint helps management to better understand their business and how to respond to change (Farrell, 1998; Van der Erve, 1998; Mason, 2007). Many researchers believe that the best way of controlling chaos is with chaos (Driver and Humphries, Miller and Budescu, and Rapaport, in Evans, 1998). They also imply that human beings, if not too strictly controlled, have a natural ability to act at the edge-of-chaos, creating the chaos needed to cope with complex/turbulent environments. Therefore, bottom-up, emergent responses might be the most effective method of coping with change. Accordingly, Brown and Eisenhardt (1998) suggest reacting to change when necessary and anticipating change when possible, forcing competitors to react. This is achieved through activities like launching of new products or setting new industry standards. By changing industry rules, companies create their own environments, not by planning, but by allowing strategic direction to emerge from constant changes in their activities. Authors such as Quinn, Mintzberg and Stacey recommend similar approaches (Brooks and Weatherston, 1997). These approaches imply small incremental changes, allowing strategies to 'emerge' from the relationship with the environment and thus developing more flexibility in the firm. This complexity approach is characterised by it being:

- Unpredictable and surprising: rapidly creating many moves, seeing which work and continuing those, thereby unsettling competitors.
- Uncontrolled: not implemented by top management but emerging from relationships between individuals and their environments.
- Inefficient in the short term, due to unsuccessful alternatives, but which are necessary for discovering long-term growth opportunities, which rarely are identified through formal planning.
- Proactive: taking the lead wherever possible – continually forcing others to react and follow.
- Continuous: many small incremental changes causing strategy to evolve.
- Diverse: making many moves of varying size and type.

Specific management actions

Research over the past forty years, from Burns and Stalker in 1961 to current authors such as Halal (1996) and Baskin (1998), has shown the inadequacy of command and control management for conditions of turbulence and change. Therefore, an alternative management approach became necessary and Halal (1996; p. 2) maintains that management theory has moved progressively towards an organic approach. Baskin (1998) maintains that corporations should be run like living things, by continually learning from, and adapting to, their environment. Organic structures are more like a colony of bees or a tree, and therefore cannot be controlled like a machine. Only “living systems operating on self-organizing principles” can cope in turbulent environments (Halal, 1996; p. 2) and are, by definition, “out of [managements’] control”. To implement ‘organic management’ Fradette and Michaud (1998; p. 116) propose five managerial actions to create “self-adapting, self-renewing companies that are organised for instant action” actions unlike the traditional planning, organising and controlling. These are:

- Set strategic purpose: a broad vision that guides workers as to the domain in which the company should operate.
- Set strategic boundaries: so that actions contribute to competitive advantage.
- Enable and encourage workers to challenge boundaries: important to avoid stagnation by correcting or eliminating a redundant boundary.
- Champion market and customer events: encourage worker participation in the exchange of ideas, and promote the champion’s own ideas.
- Make decisions in real time: to achieve flexibility and rapid response, confidence in colleagues and employees is needed for quick decisions.

Organic management involves leaders who “are designers, teachers and stewards” rather than “bosses who call the shots” (Senge, 1990; p. 9). Baskin (1998; p. 153) sees the organic manager’s job as creating an environment in which workers push the company to co-evolve with its markets. Managers’ main tasks are to:

- Create awareness of the turbulent market and of what is needed to co-evolve.
- Increase information flow to learn about and better satisfy customers’ needs.
- Create trust to enable workers to co-operate better. Trusting independent workers is essential in a rapidly changing and complex environment.

Similarly, Farrell (1998; p. 56) sees the manager’s role as making sense of the complex system, identifying emerging forces and patterns and influencing the system to develop in a direction in the manager’s favour. This means he must “gather the right data, recognise patterns, see where systems are ready to break, and build in the ability to create a wide range of futures.” A successful manager helps staff cope with turbulence and change. Joubert (1998) stresses that it is important to keep employees focused to avoid complacency, which can lead to missed opportunities. It is important to “create dissatisfaction with the status

quo” to encourage change and “the starting point is to shake up their world” (Manning, 1989; p. 182). In other words, introducing some chaos is necessary to encourage change. This is consistent with an entrepreneurial orientation that is more effective in turbulent environments due to emphasis on autonomy, innovation, calculated risk-taking, proactiveness and competitive aggression (Mason, 2006).

Complexity type activities are also necessary for control in a turbulent environment. Fitzgerald and Eijnatten (1998; p. 269) suggest self control, usually through self-managing teams, to loosely control the work processes. The main task is to create conditions that encourage individuals, teams and the system to spontaneously respond to changes. This is because staff close to the action are more sensitive to environmental forces than managers. In order to increase ‘local control’, companies are delegating decision-making to lower levels. The nature/profile of such staff who can cope with such change tend to be independent (not needing to continually refer to superiors, i.e. Eisenhardt and Sull, 2001), highly trained and motivated (Siebel and Malone, 1996), decisive (Doyle, 1998), aggressive (Tasaka, 1998), more inclined to take risks (Fradette and Michaud, 1998), entrepreneurial (Black and Farias, 1997) and comfortable with change (Kelly and Allison, 1999). For such local control and decentralised decision-making, information should be available to staff who require it. The advantage is that every employee is a collector of information, which is then available wherever it can be useful. Information should cover “what’s happening within the organisation, . . . within the company’s markets and . . . in the wider world” (Baskin, 1998; p. 2). In a turbulent, rapidly changing world, a clear picture of what is happening is essential. This is encouraged by job roles that operate across departmental and company boundaries (Prendergast and Berthon, 2000) and job rotation amongst staff (Ford, 1997).

Accumulation of information can be seen as a learning process. According to Stewart (1996; p. 125), corporate learning is a social process and happens in “communities of practice”. These are informal groupings of people bound by a common problem. They occur informally, during drinks after work, around the water cooler, in the tearoom. To encourage cross-fertilisation and learning, companies should encourage informal communications: the use of an intranet, use of the boardroom by staff or funding a staff get-together. But they must remain informal, decentralised and unmanaged to ensure they are not seen as centrally controlled, management functions. Also of importance is teamwork, especially cross-functional teams, which is helpful for implementing matters discussed informally (Stacey, 1992; Wall and Wall, 1995). In summary, management in a complex/turbulent environment should be organic, with managers concentrating on creating an internal environment conducive to co-evolution. Decision-making should be decentralised, learning and experimentation facilitated and change encouraged. Management must provide information to support this approach, encourage informal information gathering, and control through self or group control. Based on this literature review, it can be seen that managers’ perceptions of the environment, the actions they adopt (see Table 1 below for listing) and their attitudes to change are important in a complex/turbulent environment such

as South Africa. Therefore it was decided to investigate whether these variables, in complex/turbulent environments, differed from those in simple/stable environments, and whether they correlated in any way with business success.

Method

The research was conducted in South Africa, where all components of the external environment are turbulent (Mason, 2004). The research problem was complicated as it involved the *level* of turbulence and complexity, *perceptions* of managers, their *attitudes* to change, *styles* of management and the *degree* of success. This complexity dictated the need for a qualitative exploratory study, as did the fact that relatively little research had been done on the intersection of chaos/complexity theory and these managerial issues. Padgett (1998; p. 7) suggest qualitative research when “You want to explore a topic about which little is known.” The case study method was chosen to study the problem intensively (Welman and Kruger, 1999). To improve the rigour of the study (sometimes a problem in qualitative research) a comprehensive research protocol was developed (Yin, 1994). Two companies each in a simple/stable and a complex/turbulent industry were selected to represent more and less successful companies. Maximal variation sampling was used to select the companies. This method strives “to integrate only a few cases, but those which are as different as possible, to disclose the range of variation and differentiation in the field” (Flick, 1998; p. 70). The sample was selected through a two-stage process, as follows.

First, the most complex/turbulent and most simple/stable industries were selected via a questionnaire sent to a list of stock brokerage industry analysts and management consultants, developed from appropriate directories. It questioned the experts on the complexity and turbulence in seven external environment sub-categories in 19 industries. Six useable questionnaires were returned and analysed. The results highlighted the Information Technology (IT) industry as the most complex/turbulent and the packaging industry as the most simple/stable industry. Figure 1 below shows these findings.

Within each industry, a more successful and a less successful company was chosen, based on a Delphi process (Caldwell, 2000; Roberts, 2000), using a panel of four experts (consultants, journalists and buyers) specialising in each industry. The experts were chosen using a judgemental sampling method, after discussions with knowledgeable people in both industries. The experts were briefed on the required process, including a definition of what was meant by ‘successful’. A two-iteration, ranking process of the more successful and less successful companies resulted in the panellists nominating CA as the more successful and CB as the less successful companies in the IT industry, and PA as the more successful and PB as the less successful companies in the packaging industry. Data was collected via semi-structured focussed depth interviews (Yin, 1994) with 31 CEOs, directors, managers and marketing and sales staff in the four companies. All 31 met Morse’s (in Flick, 1998) criteria for being good informants. To obtain the companies’ co-operation anonymity was promised. Interviews took between an hour and an hour and a half each, were based on

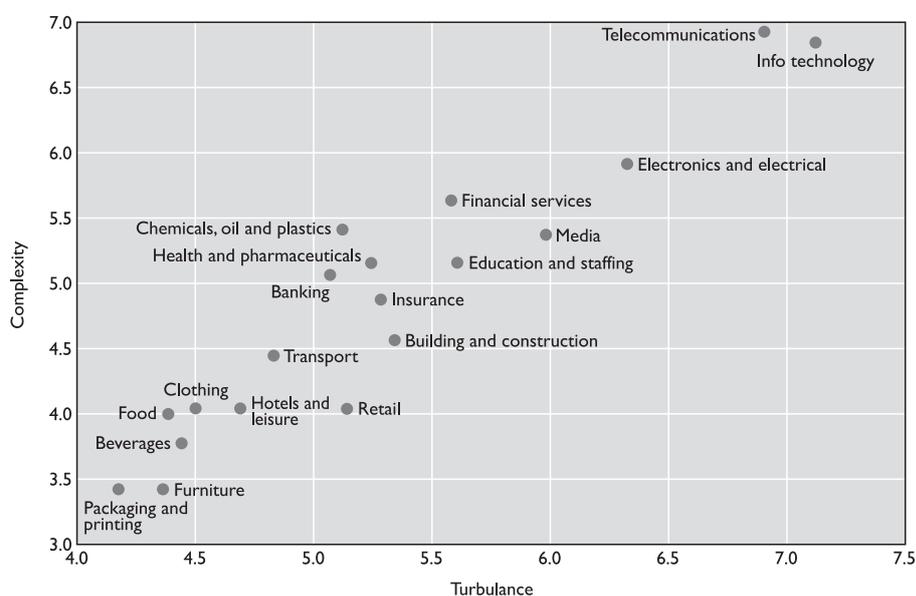


Figure 1: Complexity and turbulence by industry

an interview guide developed from the literature review and were audiotape recorded. In addition, field notes were taken. Furthermore, various company documents were collected and analysed, for example, annual reports, stock exchange prospectuses, brochures, leaflets, web pages, advertisements, meeting minutes and agendas, and policy and procedure manuals. The interview guide and the document summary sheets were structured mainly in terms of the management issues or variables identified from the literature review. Table 1 below presents these issues.

A combination of techniques was used to analyse the material. Thematic coding using NVIVO software, was used to deconstruct and reconstruct the transcripts to categorise findings according to the perspectives being studied (stable/turbulent; more/less successful). Each code, and its associated set of extracts, was manually analysed, looking for patterns of similarities and differences in the themes or initial codes. These 'pattern codes' constituted the themes, causes/explanations and relationships that are discussed in the findings section of this paper. Content analysis (via Excel spreadsheets) was used to paraphrase field note and document data to generalisations to compare them with the research problem. Manual analysis summarised and aggregated the notes and documentary evidence into tables to compare the two companies in each industry against each other, and to compare the two companies similar in success to each other.

'Method-appropriate criteria' such as data triangulation, methodological triangulation, prolonged engagement and an audit trail were used to validate the procedures and to ensure trustworthiness in the study (Flick, 1998). These multiple data collection methods provided both 'outsider' and an 'insider' perspective, thereby increasing rigour and trustworthiness (Denzin and Lincoln, 1994). Construct validity was increased by using multiple data

Table 1: Issues investigated

Categories	Specific issues/Variables	Cited references
Environment	Managers' perceptions of environmental turbulence	Farrell (1998); Van Der Erve (1998).
Attitudes to change	How companies react to/cope with change	Manning (1989); Wheatley (1996); Hamel (2000).
	Preparedness to disrupt environment	Evans (1998); Brown and Eisenhardt (1998); Doherty and Delener (2001).
	Cycles of change – long/short term	Wall and Wall, (1995); Doherty and Delener (2001); Holbrook (2003).
General management	Company's vision/philosophy	Fradette and Michaud (1998).
	Management style – democratic/autocratic	Senge (1990); Baskin (1998); Kelly and Allison (1999).
	Relationships amongst staff	Stewart (1996); Fradette and Michaud (1998).
	Internal communication – methods, openness	Stewart (1996); Baskin (1998).
	Policies and procedures – formality	Halal (1996); Baskin (1998).
	Planning approaches – formality	Stewart (1996); Brooks and Weatherstone (1997); Brown and Eisenhardt (1998).
	Decision making – level, decentralisation	Stewart (1996); Fradette and Michaud (1998); Fitzgerald and van Eijnatten (1998).
Structure and staffing	Profile of staff – age, personality, etc.	Siebel and Malone (1996); Black and Farias (1997); Doyle (1998); Tasaka (1998); Fradette and Michaud (1998); Kelly and Allison (1999); Eisenhardt and Sull (2001).
	Knowledge, skills	Fitzgerald and van Eijnatten (1998); Baskin (1998).
	Job roles and stability	Ford (1997); Prendergast and Berthon (2000).
	Team work	Stacey (1992); Wall and Wall (1995); Fitzgerald and van Eijnatten (1998).

sources, internal validity was increased by comparison and pattern matching across the cases, external validity was increased by using cross-case analysis of multiple cases (thereby allowing some generalisation), and reliability was increased by the use of a data collection protocol, and the keeping of a data base of the empirical data and a chain of evidence (Yin, 1994; Riley *et al.*, 2000). The method adhered to the ten design considerations of Lincoln and Guba and therefore met the criteria for a high quality, rigorous and trustworthy study (Rudestam and Newton, 1992).

Findings

Environment and change

There is a significant difference between CA and CB despite the fact that they both view their environment as rapidly changing, turbulent and complex

Table 2: Environment and change findings

Env.	Findings	Evidence – extracts from interviews
T/C	CA – master of, and encouraging, change, thereby handling environment better. Emphasise development rather than efficiency. Aggressive.	“... try and change the playing fields” “... shake the market up ... we try to make new markets all the time.” “... remain agile, constantly innovative and open to change.” “... focus on the industry’s highest growth sectors.”
	CB is passive, battling to cope with changes after they happen.	“... explored a lot of avenues, but ... we don’t have to rush this.” “... follow ... clones ... they set the trend ... it is a lower risk aspect.” ... but we don’t cause change.”
S/S	PA – technology only turbulent. PA – change quickly to gain competitive advantage, innovative.	“Technology ... is changing phenomenally fast.” “I think we adapt very quickly – we can change very quickly.”
	PB – all environment is turbulent. PB – only change when forced to.	“[Our traditional market is] extremely unstable at the moment.” “The move away from (traditional market) ... forced on us.” “I think we hold back until information is available.”
	PA and PB – Turbulence is controlled to return to equilibrium, or is avoided.	PA – “... build our capacity ... increase profits ... by consolidation.” PB – “If we get away with what they have got, they will stick with it.”

(T/C). CA welcomes change, whereas CB avoids it and delays taking any actions until forced to. In the simple and stable environment (S/S), PA and PB both viewed the technological component as turbulent, but differed on the remainder of their environment. PA is proactive and takes decisions quickly, while PB operates as if there is no change. These findings are as expected of successful/less successful companies in these environments and are expanded on in Table 2, above.

General management

The main differences between the two T/C companies were in vision/philosophy and planning, while the two companies were similar in management style, staff relationships, internal communications, policies and procedures, and decision-making. These findings are detailed in Table 3, below. The similarity of issues in the two companies could indicate that the relationship between environment and management has no impact on success, or that CA are more successful because they implemented these management approaches better than CB, or that CB applied a T/C approach in an environment they do not truly perceive as turbulent and complex, a contradiction that could cause weaknesses in other operational areas. Other than strategic planning, general management issues were all different between the two S/S companies. This could be because the packaging industry is sufficiently turbulent to warrant T/C type management, or because this type of management (democratic, participative) is superior in any environment, which could explain PA’s superior performance.

Table 3: General management issues

Env.	Findings	Evidence – extracts from interviews
T/C	Vision/philosophy and planning different	CA – “Leaders and number one in our field”, “results driven”, “make your target”, “expect to see heavy profits”, “numbers driven.” CB – “Commitment to staff”, “emphasis on product”, “solutions for client”, “trend followers, . . . not . . . market leader.”
	Management style similar Internal communications similar Decision-making similar	CA – “I am not the dictatorial ‘you will’ type boss.” CB – “We try not to control people.” CA – “Corridor talk” and “discussions at lunch time.” CB – “Discussions over coffee and cigarettes.” CA – “. . . decisions are made on the fly and . . . made very quickly.” CB – “Decisions are taken quickly, but by a body.”
S/S	Management styles different	PA – “The company has always had a very open way about things.” PB – “Guy in charge was . . . regimental . . . do what he wanted.”
	Internal communications different	PA – “Tea in the canteen and you will discuss a whole lot of stuff” PB – “Not really encouraged because of production downtime.”
	Policies and procedures different	PA – “There are no rules. There is no formal procedure.” PB – “No . . . bypassing the procedure . . . hesitate to take a decision.”

Structure and staffing

In the T/C environment internal communications, staff relations, policies and procedures, knowledge and skill, management style, and teamwork were similar in the two companies. Staff profiles and job stability were different, as is shown in Table 4 below. These findings are as expected from the literature. In the S/S environment similarities exist in knowledge and skills, teamwork, and job security. Staff profiles, job roles and structures are different, as shown in Table 4 below. These findings were the reverse of what was expected from the literature. It may be that the environment does not determine human resource or staffing issues in a simple/stable environment, and may not influence success. An overall conclusion seems to be, as suggested earlier, that there is a superior management method (which includes structural and staffing issues) that correlates with success, regardless of the environment.

Summary of findings

To provide an overview, each main issue was summarised according to the environment and success levels, and cross-tabulated for the three analysis methods – interview transcripts, documents and field notes. These cross tabulations are provided in Table 5 below. Ticks indicate that findings were

Table 4: Structural and staffing issues

Env.	Findings	Evidence – extracts from interviews
T/C	Staff profiles different	CA – “Young, individual, strong entrepreneurs, who have an idea where they want to go individually, they have their own goals” CB – “Everything works in teams . . . collaboration and co-operation”
	Job stability different	CA – “Don’t perform, they’re not going to be around . . . know that” CB – “Don’t get rid of people easily, . . . there is value in everyone”
S/S	Staff issues and profiles different	PA – “We want guys who can learn easily . . . not set in . . . ways” PB – “The staff turnover here is almost negligible”
	Job roles, structures, relationships, procedures different	PA – “Loose, it overlaps . . . you can get involved in anything. We help each other . . . no such thing that you . . . hold your position” PB – “It is a very tight ship, everybody knows their job . . . it very seldom overlaps”

generally consistent with the literature, while crosses indicate that findings were the reverse of expectations. A cross and tick together indicate ambiguity, some issues being consistent with the literature, and others not.

In an attempt to quantify these findings, a score of 2 for a tick, 0 for a cross, and 1 for a tick and cross was allocated to create a quantitative table, presented as Table 6 below. The Gross Percent row indicates the degree to which the findings correlated with the suggestions from the literature.

This summary confirms that the findings for companies in the complex/turbulent environment were consistent with what the literature suggested. The simple/stable findings, however, were not consistent, with the expectations for this environment not as suggested by the literature. The perceptions and management behaviour of both the more successful companies is consistent with the suggestions for a more successful company in a complex/turbulent environment, while the behaviour of both the less successful companies is consistent with the suggestions for a less successful company in a complex/turbulent environment. This indicates that the packaging industry is turbulent and complex, probably because the whole South African

Table 5: Summary conclusions

Factors	Turbulent/complex						Stable/simple					
	CA – More successful			CB – Less Successful			PA – More successful			PB – Less successful		
	IV	DA	FN									
Environmental and market change	√	√	√	√	√	×	√	×	√	×	√	×
Attitude to change	√	√	√	√	√	×	×	×	×	×	×	×

Table 6: Summary conclusions with quantitative scores

Factors	Turbulent/complex						Stable/simple						Total	%
	CA – More successful			CB – Less Successful			PA – More successful			PB – Less successful				
	IV	DA	FN											
Environment and market change	2	2	2	2	2	0	2	0	2	0	2	0	16/24	70.8
Attitude to change	2	2	2	2	2	0	0	0	0	0	0	0	10/24	45.8
General management	2	2	2	0	2	1	0	0	0	0	0	0	9/24	37.5
Structure and staff	2	2	2	2	0	1	0	0	2	0	0	0	11/24	45.8
TOTAL	8/8	8/8	8/8	6/8	6/8	2/8	2/8	0/8	4/8	0/8	2/8	0/8	46/96	47.9
PERCENTAGE	100	100	100	75	75	25	25	0	50	0	25	0	47.9	
GROSS SCORE	24/24			14/24			6/24			2/24				

environment is turbulent and complex, in which case the literature suggestions for complex/turbulent environments should be applied. On the other hand, the behaviour proposed by the literature provides success regardless of the level of turbulence and complexity. Therefore, the management approaches suggested should be adopted regardless of the environmental state. In addition, a subsequent content analysis of the raw data indicated that both the more successful companies used change-oriented words more than the other two companies, which may indicate a greater awareness of the environment, its turbulence and complexity, and the need to cope with such turbulence and complexity. Such awareness could be a key to success, and may be what is important, especially in turbulent and complex environments.

Discussion of managerial implications

If we accept that business environments are complex adaptive systems, then the key issues for managing in such complex and turbulent environments is to accept the unpredictable nature of these systems, to accept that they cannot be centrally controlled and to accept that a 'senior manager' cannot effectively direct and control such a system. Accepting these principles means, first, to accept change as an inevitable occurrence and as something that provides positive opportunities. Therefore, awareness of the external environment and its changes must be continuously promoted amongst all staff. Second, it means adopting a different way of managing. This requires a clear vision of what the company is and what it wants to become, and this needs to be regularly and continuously communicated to all staff. For example, regular meetings should be predicated on this vision, using common and consistent language, promoting trust and emphasising mutual understanding. Such a vision can be seen, in chaos terms, as a strange attractor, providing the

boundaries or limits within which the firm will operate, and providing guidance for devolved decision-making.

Strategy-setting should be different, including both the traditional top down approach as well as a bottom up approach to incorporate the decentralised knowledge of staff at the 'coalface'. Those at the 'coalface' are more likely to become aware of changes and trends early, and pick up on the 'weak' signals that hint at the initial conditions of a changing system. This is in line with the concept of sensitive dependence on initial conditions and the 'nudge' type actions suggested by Nilson (2005). Thus, strategy making should be seen as a continuous, emergent process, and not only as an annual planning process. Since this is contrary to the traditional strategy-making process, training in emergent strategy making would be necessary for managers involved in, or with responsibility for, strategy. Decentralised decision-making is essential in turbulent environments. Staff members should be given responsibility and authority over matters at their level of operation. This would encourage the innovation and proactiveness required of an entrepreneurial orientation, allowing market leadership, technological developments and risk taking to emerge when required. In complexity terms, this will permit the staff in the firm to self-organise and respond spontaneously to changes in the environment, and thereby keep pace with rapid change. Since accurate prediction is not possible in a turbulent and complex environment, planning should have a short time horizon. Such planning requires free distribution of information, which is used quickly, and should be about 'how to do things' rather than 'what to do'; that is, adapting to changes rather than trying to predict and control activities. To achieve this, staff will initially require encouragement and guidance to instigate self-organisation. Human resource areas of staff appraisal and career development could be of assistance in initiating self-organisation.

Dealings with all staff should be open and transparent. They should have wide access to information about the firm, its performance, future plans and a clear vision and idea of who they are and where they want to go in the future. To achieve this management should encourage the generation and exchange of information. This can be further facilitated by the development and encouragement of relationships, both formal and informal, in internal and external networks of connections. The resultant, and desired, self-organisation can only emerge in a democratic environment that devolves power to staff members on the understanding that they are capable and responsible. In other words, all staff must be freed to 'use their brains, and not just their brawn', to contribute to company performance. Such self-organising and democratic activities are mostly conducted by small, informal groups of people, often from across different functions or disciplines in the firm. Therefore, management should encourage informal meetings, get-togethers or social events, in order to facilitate the networking that leads to the emergence of new ideas or strategies. To make this approach work, management has to develop a high level of trust in their staff. This is the true meaning of a participative management style! Human resource activities become critical if a firm is to trust and rely on its staff to self-organise, handle devolved responsibility and authority, and to 'use their brains'. Selection and recruit-

ment, training and development, and motivation are important to ensure that staff capable of handling this responsibility are employed. Because of rapidly changing environments, expertise and experience are essential to be able to adapt to these changes without having to relearn for every decision. Therefore every effort must be made to maintain corporate knowledge by reducing the turnover of staff. In fact, the levels of expertise and experience should be grown through job security, training and development and job rotation.

Limitations

Since this was a small sample exploratory study, the findings are not necessarily representative of all companies in the sampled industries, or of similar environments. However, the objective was to 'throw light' on the relationships between the issues and not to generalise to other industries or environments. The study has provided a better understanding of these relationships, but if extrapolation to other industries is attempted it should be done cautiously.

Future research

Although the complexity perspective has cast new light on management, there is still much to be learnt about management in complex/turbulent environments. Further research using complexity theory may provide a greater understanding of relationships between management activities and the business environment. Resolution of the above limitation and expansion of knowledge could be achieved through further research in the following areas:

- Research into many companies and industries could test whether these findings are general to other South African firms and to other countries.
- A quantitative study of one industry could more clearly differentiate the managerial behaviour of more successful from less successful companies.
- Quantitative measurement of environmental complexity and turbulence could resolve whether all South African industries are complex and turbulent.
- Research in a country that does not experience South Africa's extremes of complexity and turbulence may be better able to differentiate between management activities in complex/turbulent and simple/stable environments.

The recommendations will be difficult to achieve due to measurement problems, confidentiality issues and uncertainty about what specifically to observe and measure. Nevertheless, the likelihood that complexity theory will help to unlock greater knowledge about management makes tackling these challenges important and worthwhile.

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