

Scenario analysis as a strategic management tool

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Abstract

This paper is about the role of scenarios in strategic management. Generally, a scenario depicts some feasible future state of an organisation's environment and mostly includes the dynamic sequence of interacting events, conditions and changes that is necessary to reach that state. The scenario approach changed considerably during the last two decades. This is reflected in the different functions ascribed to scenarios. The more traditional functions (in first generation scenarios) are tool for evaluation and selection of strategies, integration of various kinds of data, and exploration and identification of future possibilities. The more recent ones (in second generation scenarios) are making managers aware of environmental uncertainties, stretching of managers' mental models, and triggering and accelerating processes of organisational learning. The paper discusses especially the latter cluster of functions which are closely linked to each other.

By linking the dynamic scenario-development process to Kolb's learning cycle and strategic management, the strategic learning cycle can be enhanced. The strategic learning cycle elucidates a number of bottlenecks that may seriously hinder learning within strategic management (e.g. cognitive inertia and feedback lags). Scenarios seem to dissolve these bottlenecks and in doing so support strategic learning.

1. Introduction

Since the oil shocks upset the business world in the 1970s, both academics and practitioners have propagated multiple scenario analysis to deal effectively with the many long-run uncertainties that surround business organisations. Stimulated by the successes of Royal Dutch/Shell achieved in anticipating and exploiting these oil shocks, some ten years later approximately half of the largest European and US companies stated they use scenario analysis to support long range decision-making (Hooley, 1984; Linneman and Klein, 1983; Malaska, 1985). Although recent surveys are lacking, the large number of articles that has been published in the last decade suggests the percentage of firms can only have grown.

The rise of multiple scenario analysis has been largely ascribed to the failure of traditional forecasting techniques to provide credible forecasts in the past few decades (Bunn and Salo, 1993; Grayson, 1987; Schnaars, 1987; Schwarz, 1988; Wack, 1985a). Linneman and Klein (1983), for example, reported that only less than one-third of the US industrial companies they studied were satisfied with trend projecting techniques for fulfilling their long-range forecasting needs. The real problem with such analytical techniques is that they produce forecasts by extrapolating the past and in doing so implicitly view the world as essentially stable. As most business managers experience every day environmental reality is full of unexpected changes and discontinuities which make long-term forecasts often worthless the moment they are produced. To effectively deal with these turbulence, managers increasingly substituted scenario analysis for forecasting techniques.

Multiple scenario analysis is praised for the radically different stance it takes towards environmental uncertainties. Whereas trend projecting forecasting techniques try to abandon any uncertainty by providing managers with only one forecast, multiple scenario analysis deliberately confronts managers with environmental uncertainties by presenting them several, fundamentally different outlooks on the future (Millett, 1988; Schoemaker and Van der Heijden, 1992; Wack, 1985a). Generally, a scenario depicts some feasible future state of an organisation's environment and mostly includes the dynamic sequence of interacting events, conditions and changes that is necessary to reach that state (e.g.,

Raubitschek, 1988). According to Kahn and Wiener (1967), two pioneers within the area of scenario analysis, scenarios focus attention on causal processes and crucial decision points. In doing so, scenarios highlight fundamental uncertainties surrounding the (strategic) decisions managers have to make.

While the preceding 'forecasting-substitution' argument still holds, the scenario approach has undergone some considerable changes since its introduction. Newly developed functions have, without any doubt, increased the attractiveness of multiple scenario analysis to managers. Whereas scenarios at first only contributed to one or two distinct phases in the process of strategic decision making - for example the evaluation of alternative strategies - multiple scenario analysis is now claimed to support this entire process, enclosing aspects as varied as the generation of options (Schoemaker and Van der Heijden, 1992; Van der Heijden, 1996) and the building of consensus (Tenaglia and Noonan, 1992). However, we currently do not know much about what is going on during the construction and use of scenarios although some notable first attempts have been made (e.g., Jungerman and Thüring, 1987; Schoemaker, 1993). Some basic questions remain. The one we want to elaborate in this paper is how a seemingly plain methodology can fulfil the diverse range of functions ascribed to it in the literature on multiple scenario-analysis.

The goal of this paper is to increase our understanding of *why* multiple scenario analysis is as effective as a strategic management tool as it is claimed to be. For this purpose we take a cognitive perspective on scenario analysis. In addition, but closely related, we will draw upon research carried out within the field of organisational learning. In the first part of this paper we will shortly lay out the scenario methodology and categorise the various functions that have been ascribed to multiple scenario analysis in the last few decades. In the second part we will develop a conceptual framework for understanding the cognitive processes at work during the scenario process. The core of this framework consists of what we denote as 'the strategic learning cycle'. In the third and final part we employ the developed framework to enlarge the understanding of the scenario process.

2. The scenario methodology

Various models for construing scenarios can be found in the literature (e.g., Godet, 1987; Huss, 1988; Porter, 1985; Schwartz, 1991; Reibnitz, 1988; Van der Heijden, 1996). Although scenarios are far from constructed in some kind of standardised process and various differences can be observed between the various models, in broad outline they all have the same basic structure. As shown in figure 1, a typical scenario process consists of a series of phases which are, at least intentionally, completed sequentially. The process depicted in figure 1 shows most resemblance with the steps to developing scenarios as outlined by Schwartz (1991). In practice, construing scenarios almost automatically results in an iterative process wherein people move back and forth between the interrelated phases. Moreover, while to some managers such an orderly process may call for delegation to a staff department, various authors stress that line managers themselves should be actively involved in the scenario process (e.g., Schwartz, 1991; Tenaglia and Noonan, 1992).

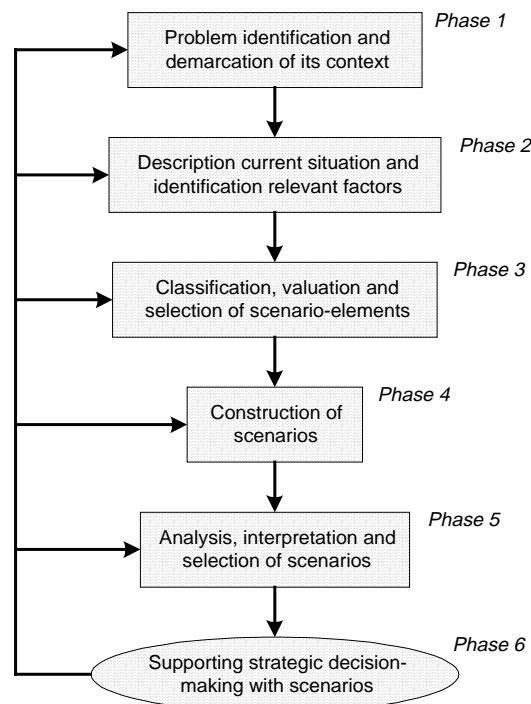


Figure 1
The process of scenario development

A scenario process starts with identification of a focal issue or decision which constitutes a real problem to the management. During this phase the local context of the focal issue is demarcated, which may include the identification of the managers (likely to be) involved with it and the time horizon of the scenario study. Next, the current situation is studied and relevant factors are identified; a SWOT-analysis may serve as a useful starting point. The importance of this step is highlighted by Godet's (1982) observation that the future originates from the present and takes shape through complex interactions between many decisions and actions made and carried out by various people and organisations and both small

and fundamental environmental changes. As a result, some insight into the future may be discernible in the present.

In particular the factors that fundamentally determine future developments are crucial. These ‘driving forces’ (Schwartz, 1991) or ‘causal factors’ (Porter, 1985) are subsequently classified as either constant, predetermined or uncertain (Porter, 1985; Wack, 1985a). This classification constitutes a crucial step in the scenario process as the uncertainties determine the differences between the scenarios while the constant and predetermined elements are the same for every scenario. By artificially varying fundamental uncertainties each scenario depicts another future state. In doing so the scenarios together highlight the importance and consequences of these uncertainties. To be accepted by managers the scenarios constructed have to be, understandable, feasible and internally consistent. They do not have to reflect the “most likely” future nor one entitled as “good” or “bad” as such qualifications are meaningless given the host of future uncertainties. The construction phase starts as the logics or plots for the scenarios are selected and ends with stylized stories normally.

The scenarios are then ready for use or, as Schwartz (1991) puts it, for ‘rehearsing the future’. They can be analysed and interpreted by managers within the context of the problems they face and the decisions they have to take. There are several ways to organize this last phase, ranging from incidental usage by an individual manager to structured workshops for complete management-teams. Notably the scenario literature strongly suggests that the active construction process of the scenarios (phase 1 to 4) is as important for the organisation, even if the scenarios are not actually used (in phase 5 and 6).

Functions of scenarios

The preceding scenario process is relatively straightforward and does not seem to leave much room for many obscurities, if any. Nevertheless, although the basic structure of the scenario process has not changed much, new functions have been ascribed to scenario analysis through the years. Noteworthy is that these functions mainly grew out of practice and were mainly developed by managers and consultants when actually developing and using scenarios. Most academics only became interested as they tried to explain their working and effect. Moreover, as in

the early years of scenario analysis, Royal Dutch/Shell has played a prominent role in this developmental process (e.g., De Geus, 1988; Schoemaker and Van der Heijden, 1992; Schwartz, 1991; Wack, 1985a/b). Multiple scenario analysis is now claimed by various authors to fulfill a wide range of different functions. Some of these functions are concrete and clearly visible, while others, especially the newer ones, are more abstract and bring about intangible products. Table 1 summarizes the main functions of scenarios.

Original functions:

1. *Evaluation and selection of strategies*
2. *Integration of various kinds of future-oriented data*
3. *Exploration of the future and identification of future possibilities*

More recently added functions:

4. *Making managers aware of environmental uncertainties*
 5. *Stretching of managers' mental models*
 6. *Triggering and accelerating processes of organisational learning*
-

Table 1
Functions of scenarios

First, scenarios can serve as a background for the *evaluation and selection of strategies* (Kahn and Wiener, 1967). According to Beck (1982: 17), scenarios can 'provide a framework within which all the various factors and information can be more effectively and easily judged by the decision-maker'. Both Leemhuis (1985) and Porter (1985) presented concrete approaches for selecting strategies. Leemhuis (1985) developed a payoff matrix in which the results from each strategy in different scenarios is calculated. Because mostly no single strategy performs best in each scenario, Porter (1985) formulated five guidelines for selecting a strategy, like 'bet on the most probable scenario' or 'preserve flexibility'.

Second, better than any other future-oriented tool, scenarios offer the possibility to *integrate various kinds of data* in a consistent manner. Besides quantitative data, scenarios can handle qualitative input (Huss, 1988), incorporate results from other forecasting techniques and allow for “soft” and “fuzzy” variables (Linneman and Klein, 1985; Wack, 1985a). This function is especially useful as a considerable part of the knowledge used in formulating strategies is qualitative in nature.

Third, scenarios are a means to *explore the future and identify* what might possibly happen and how an organisation can act or react upon future developments. In fact, Kahn and Wiener’s (1967: 6) early definition of scenarios emphasises this function by defining scenarios as ‘hypothetical sequences of events constructed for the purpose of focusing attention on causal processes and decision-points’. Good scenarios enlarge managers’ understanding as to what is significant versus ephemeral (Schoemaker, 1993). This allows for anticipation of the unexpected and provides for an early warning system (Grayson, 1987; Wack, 1985b). Organisations may even develop several contingency plans on basis of the scenarios (Raubitschek, 1988) or an environment monitoring system (Reibnitz, 1988). By exploring and anticipating the future, scenarios can help to identify major changes and strategic problems an organisation will be facing in the future as well as to generate strategic options to effectively deal with them.

Fourth, a function of scenarios that has increased in importance from the seventies onwards, and which is central to multiple scenario analysis nowadays, is making managers *aware of environmental uncertainties* (Porter, 1985; Wack, 1985a). Multiple scenario analysis brings uncertainty into the management process by confronting them with fundamentally different future states. As uncertainty is a basic structural feature of the business environment nowadays, ‘the better approach is [. . .] to accept uncertainty, try to understand it, and make it part of our reasoning’ (Wack, 1985a: 73).

Fifth, ever since Wack’s (1985a/b) seminal *Harvard Business Review* articles, scenarios are seen as ways to *stretch managers’ mental models* by explicitly confronting them with their own biased viewpoints. Based on education and experience, amongst other things, every manager has developed his own mental model on basis of which he acts. Mental models are personal descriptions of situations formulated in abstract terms as opposed to concrete descriptions of

specific situations (Johnson-Laird, 1983). Mental models both contain personal explanations of situations and guidelines for action in these situations. Scenarios aim at challenging managers' existing mental models and entrenched corporate convictions (Millett, 1988). Tenaglia and Noonan (1992) claim that by surfacing and testing (implicit) mental models scenarios facilitate the building of consensus within a management-team. In this sense, scenarios function as a communication tool (Millett, 1988).

Finally and closely related to the foregoing function, scenarios are increasingly considered as tools *to trigger and accelerate processes of organisational learning*. Learning on a strategic level is hindered both by the long timespan that elapses between action and result and the cognitive inertia people demonstrate when absorbing new information and adapting their mental models accordingly. Scenarios as representations of the real world can serve as 'transitional objects' with which managers can 'play' and in doing so learn considerably faster (De Geus, 1988). This brings us right back to the first function we mentioned. By studying different representations of the world, managers are able to test and evaluate alternative strategies. Van der Heijden (1996), for example, refers to scenarios as "test-beds" and compares them with the test conditions in windtunnels (see Van der Heijden, 1996).

Clusters of functions

The preceding classification of functions holds two clusters of functions. These clusters go beyond the distinction between first and second generation scenarios as developed within Shell (Wack, 1985a). The first three functions are the most traditional ones and responsible for the origination of scenario thinking in the first place. The last three functions have been added through the years as experience with multiple scenario analysis grew. In fact, they are the main reasons behind the present popularity of scenario thinking among business organisations. Although the latter cluster of functions get most of the attention in academic and management journals in recent years, a satisfying explanation of how scenarios fulfill these functions is still missing in the scenario literature. The scenario methodology seems to tell only part of the story. It suggests that construing and using scenarios 'simply' consists of sequentially completing several distinct phases and activities.

However, in particular the newly added functions imply that something more is going on during this process. If multiple scenario analysis really accomplishes the functions ascribed to it (e.g. stimulating learning by managers and changing their thinking) another more dynamic process has to be hidden behind the rather static phase models.

Existing scenario literature reinforces the somewhat mysterious character of scenario analysis rather than clarifies it. Illustrative in this respect is Peter Schwartz' book *The Art of the Long View* in which he describes scenarios as 'a set of organized ways for us to dream effectively about the future' (1991: 4). While experienced builders and users of scenarios may not see any obscurities, to outsiders it sometimes seems as if some kind of 'chemistry' takes place during the scenario process. In the remainder of this paper we will try to increase our understanding of this dynamic process. In our opinion, this understanding is crucial; without it scenarios will only achieve these worthwhile functions accidentally and may miss their purposes regularly.

3. A cognitive perspective

Although often mentioned separately, the latter three functions are closely linked to each other. In contrast to the first three functions that have a more methodological character, each of these circle around the mental models of managers. As Wack (1985b: 140) elegantly puts it: 'scenarios deal with two worlds: the world of facts and the world of perceptions'. Modern scenario analysis aims at influencing managers' way of thinking by offering managers several fundamentally different future perspectives on the world around them. Within this context Wack (1985a, b) speaks, among other things, of 'changing the managers microcosm' and 'the gentle art of re-perceiving'. Schoemaker (1993) refers to it as 'changing managerial landscapes' and 'shifting the anchor from which people view the future'. To understand why it is useful to look at the future from various angles, we have to consider how managers, being the (potential) users of scenarios, think and act.

Perception and imagination

Above all, as ordinary human beings, managers are not the rational, omniscient actors as some strategic management theorists wanted us to believe for a long time (cf. Stubbart, 1989). Instead, managers often do not define and explore strategic problems properly and do not systematically generate alternatives. Instead they only partially study one or two alternatives that either are readily available or already favoured for a long time (Hickson et al., 1986). After they have made a choice, they often firmly stick to their initial choices even if altered circumstances require modifications (Kahneman et al., 1982). Last but not least, they base their interpretation of the outcome on its desirability (Kahneman et al., 1982). Being ordinary people, managers work within cognitive limits (March and Simon, 1958).

Whether we like it or not, we are all severely constrained in our possibilities to adequately cope with the host of different stimuli and data we are confronted with daily (Miller, 1956). Cognitive psychology teaches us that, in order to be able to act, people construe simplified mental images and impose these images upon the world around them (Kiesler and Sproull, 1982). These images function as a frame of reference for action and interpretation of the world and the data it produces (Gioia and Poole, 1984; Weick, 1979). The images are *the* world as seen through our eyes. General ways in which people cognitively simplify stimuli and data are well-known as heuristics or rules of thumb. Examples include 'wishful thinking', 'availability' and 'selective perception' (Kahneman et al., 1982).

The images people construe are stored in cognitive structures to which, through the years, various names have been given. Neisser (1976), for example, speaks of 'schemata', Schank and Abelson (1977) of 'scripts' and Weick (1979) also does refer to them as 'causal maps'. In fact, each of these descriptions highlights another aspect of cognitive structures. Taken together, they enclose norms and values, assumptions about cause and effect relations as well as rules and guidelines on how to preferably act in certain situations. The mental models, defined in the preceding paragraph as personal descriptions of situations formulated in abstract terms, are an important part of these cognitive structures. Mental models come about by simplifying stimuli and data picked up from the environment and are by definition subjective and incomplete. Because people hold different mental models, they differ in what they see as well as in how they see it. Everybody views the world around him/her from his/her own angle and, consequently, people differ in the

importance they attach to factors, developments and occurrences. Perceptual differences are, among other things, at the root of organisational politics which has different kinds of adverse effects (see e.g., Hickson et al., 1986).

Images of the future

The perceptual differences also influence the images people construe of the future, both consciously and unconsciously (Jungerman and Thüring, 1987). Figure 2 illustrates this. As we look further into the future, the number of ways in which the future may develop grows exponentially (Godet, 1982). Given their cognitive limitations people can only conceive part of this future range of possibilities. The shaded areas show the differences in imaginative faculty of two fictitious persons or groups. Within this context, the expression, 'two *know* more than one' should be rephrased as 'two *conceive* more than one'. Note that as figure 2 has only illustrative purposes, nothing can be concluded from the circumference of these areas.

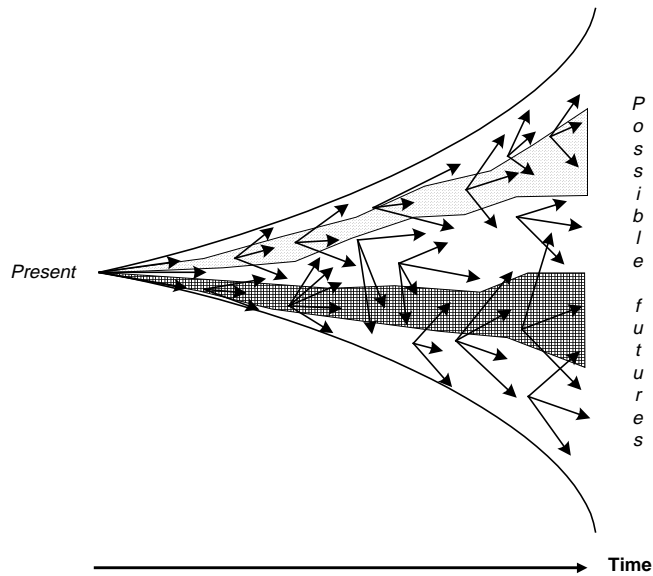


Figure 2
Limited imaginative faculty

Figure 2 can also be used to explain the principle of groupthink (Janis, 1972): due to groupthink the imaginative faculty of a group of people will narrow and the shaded area will shrink. Eventually, it may even enclose only one unique chain of possibilities. Certain sects, for example, forecast the end of the world in a certain year and are firmly convinced of it. In this particular case, the mental models of the members of the sect fully overlap. In most organisations, however, the mental models of different people will overlap only partially. To the extent that they do, one speaks of 'shared mental models' (Weick, 1979) or 'organisational codes' (March, 1991). Both refer to the dominant way in which changes and events in the environment are perceived and interpreted within the organisation. This may relate to the actions of competitors, governmental policy or demands of customers. Knowing that it does not simply enclose the aggregation of mental models, we will

in the remainder of this paper speak of ‘organisational mental models’. We will now go into the development of mental models in time.

4. Learning

Mental models are built and developed over one’s life-time and shaped by one’s social and cultural background, experience and education. Mental models change as people gain experience. Seen from a cognitive perspective, people learn as they change their perceptions after surveying and evaluating the outcomes of their actions. Kolb’s (1974) learning cycle gives a deeper understanding in the nature of these learning processes, especially within management-teams. He describes learning as a cyclical process consisting out of four phases (see figure 3).

The cycle of learning

Concrete experiences form the basis for observation and reflection. In processes of abstraction and generalisation these experiences are processed into existing mental models or result in the development of new ones. Note that perceptual actions as reading a book, watching a tennis match or studying the marketing campaign of a successful competitor are concrete experiences too. Although reading a book about Paris differs considerably from actually going there; the former is sometimes referred to as ‘borrowed experience’ (Huff, 1982). From the developed or modified mental models, new and different implications or hypotheses can be inferred which act as guidelines for new (perceptual) actions. These actions, in turn, open the way to new experiences. So, learning encloses the development of insight and knowledge of actions carried out in the past, the supposed effectiveness of these actions and the implications for future actions. Cognitive processes thus not only link the internal/personal with the external/-environmental, but also the past with the future.

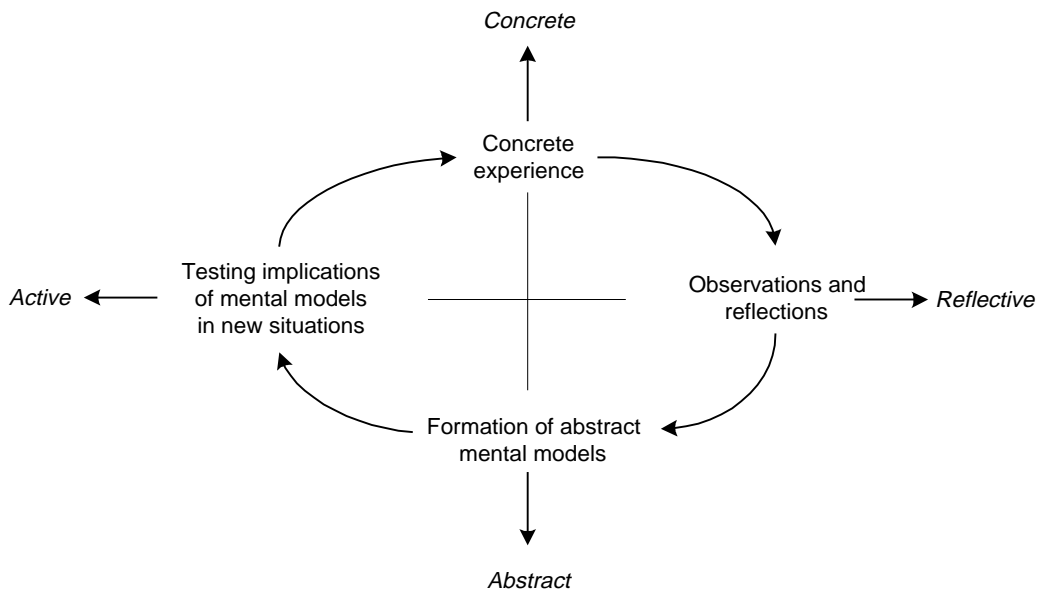


Figure 3
Kolb's learning cycle (modified)

Assimilation and accommodation

Based on his research among children, Piaget (1936, 1937) indicates that the relation between the past and the future is two-sided. The mental models influence what one perceives, but what one sees may in turn lead to modifications of the mental models. Piaget (1936) denotes these cognitive processes as 'assimilation' and 'accommodation' respectively. Assimilation is the process in which people impose their mental models to the world they live in. The opposite process of accommodation refers to the way in which people adapt their mental models to their environment. Due to accommodation new concepts and chains of argumentation enter the mental models or completely new mental models are developed. Assimilation is a more or less conservative activity through which the

environment is subjected (adapted) to the mental model of the perceiver, while accommodation is the source of change and adapts the mental model of the perceiver to the constraints imposed by the environment (Piaget, 1937). In Piaget's view, assimilation and accommodation are complementary aspects of the same adaptational process. When adjusting their mental models in response to discovered contradictions with their environment, people simultaneously assimilate those changes or objects to their mental models (Flavell et al., 1993). They adapt both the cognitive structures to the environmental reality and reality to their cognitive structures.

Interestingly but often kept unnoticed, Piaget's theory highlights that all people exhibit to a greater or lesser degree cognitive inertia. They do not change their mental models immediately and fully the moment they see themselves confronted with contradictions between the environment and their mental models. Instead, they appear to be, at least partially, conservative in holding on to their existing ideas and thoughts and selective in which elements of their mental models they eventually change. Part of what we do is fitting the environment in our mental models by mentally modifying them. People both assimilate and accommodate. As noted in the foregoing, this partly reflects a survival strategy as some assimilation is necessary in order to be able to act effectively. It can, however, also turn against us as we do not modify our mental models when we should, given some fundamental environmental changes. The more we assimilate, the more selective we become in our perception that, in turn, reduces the chances for accommodation. If we do not accommodate our mental models, they increasingly deviate from what happens around us. Unfortunately, people exhibit to a certain extent cognitive inertia. To most of us, major mental shocks are often necessary before we accommodate our mental models (or even perceive certain events or developments in the first place) and enter a learning cycle.

Skills for learning

In addition, Kolb's learning cycle elucidates that learning requires a set of quite different activities, namely, concrete experience, reflective observation, abstract conceptualisation and active implementation of the inferred implications. As shown in figure 3, these four skills represent two dimensions of learning: active versus reflective and concrete versus abstract. Effective learning requires a balance in terms of these two dimensions in that each of the four skills should get more or less equal attention. Concrete experience and active implementation stimulates accommodation. Reflective observation and abstract conceptualisation enhances assimilation. As one or two of the different skills dominates the learning process the balance between assimilation and accommodation will be distorted and effectiveness of the learning process' diminished.

Interestingly, research into the learning styles of managers has demonstrated that managers from different functional areas, differ in their scores on the two dimensions (Kolb, 1974). In illustration, marketing managers appear to be both more concrete and active, while R&D personnel score higher in terms of reflection and abstraction. Kolb concludes on basis of these results that teams should preferably be composed of people from different functional areas. Another way to ensure the balance between the four learning skills is to plan meetings in which explicit attention is paid to skills that seems to be undervalued. For example, some management-teams make trips to the countryside for a few days to 'think things over'. In Kolb's terminology' this corresponds to making time for reflection and abstraction to offset the (daily) emphasis on action and the concrete. Ideally, thinking and acting are closely intertwined in everyday life.

Exploitation and exploration

The balance between the concrete and the abstract, between assimilation and accommodation, and between action and reflection can be compared with the emphasis March (1991) lays to the equal importance of exploration and exploitation in learning on the organisational level. Exploration encloses processes such as search, variation, risk taking, experimentation, play, flexibility, discovery and innovation. Exploitation, on the other hand, includes such things as refinement,

choice, production, efficiency, selection, implementation and execution. As March (1991: 71) argues both are necessary for organisations to survive and prosper:

‘[Organizations] that engage in exploration to the exclusion of exploitation are likely to find that they suffer the costs of experimentation without gaining many of its benefits. They exhibit too many undeveloped new ideas and too little distinctive competences. Conversely, [organizations] that engage in exploitation to the exclusion of exploration are likely to find themselves trapped in suboptimal stable equilibria.’

Organisations that refine exploitation more rapidly than exploration will turn out to be pretty efficient in the short run but ineffective in the long run. As numerous companies have discovered, concentration on the exploitation of known alternatives at the expense of the exploration of the new and the unknown is self-destructive. Most of us can recall various examples of companies who played down the importance of new technological developments or new competitors (see for an excellent example the Honda case as described by Pascale and Athos (1981)).

Organisations often make both explicit and implicit choices between exploitation and exploration. Examples of explicit choices for exploration include setting up an R&D department and carrying out a multiple scenario analysis. Central in the implicit choices is the ‘organisational code’ we already referred to in the foregoing. The organisational code encloses the language, beliefs, practices and dominant ways of perception and interpretations. Individual organisational members both contribute to and adopt elements from the organisational code in a process of socialization. The contributions of new employees may be especially important in this respect.

According to March (1991) the convergence of individual beliefs and the organisational code over time (= exploitation) conceals a danger to any organisation. As individuals increasingly adapt to the organisational code they become more homogeneous with respect to the knowledge they possess. Translating this to Piaget’s (1936, 1937) terminology, this means that on the organisational level assimilation dominates accommodation. A dominance of

exploitation over exploration in an organisation will thus lead to a dominance of assimilation over accommodation and vice versa.

The centrality of balance

We conclude from the above that a certain degree of variation in perception and opinion is desirable or even necessary for organisational success. Too much variation on the other hand will also be ineffective as it may easily lead to conflicts. Organisational survival and success requires a balance between the two sets. This conclusion fits in with Fiol's (1994) observation that simultaneous agreement and disagreement is an essential component of collective learning. There has to be consensus with regard to the framing of the issues at stake but within that context enough room should be given to different and conflicting views. As an example, she puts forward that successful corporate innovation calls for the development of a collective understanding that incorporates both the new and the different.

Figure 4 summarizes the foregoing discussion: effective, successful activity requires balance between assimilation and accommodation (on an individual level), and between exploitation and exploration and between agreement and disagreement (on an organisational level). Balance between these opposites can be brought about by effective learning cycles which, in turn, require balance in terms of both action and reflection and the concrete and the abstract.

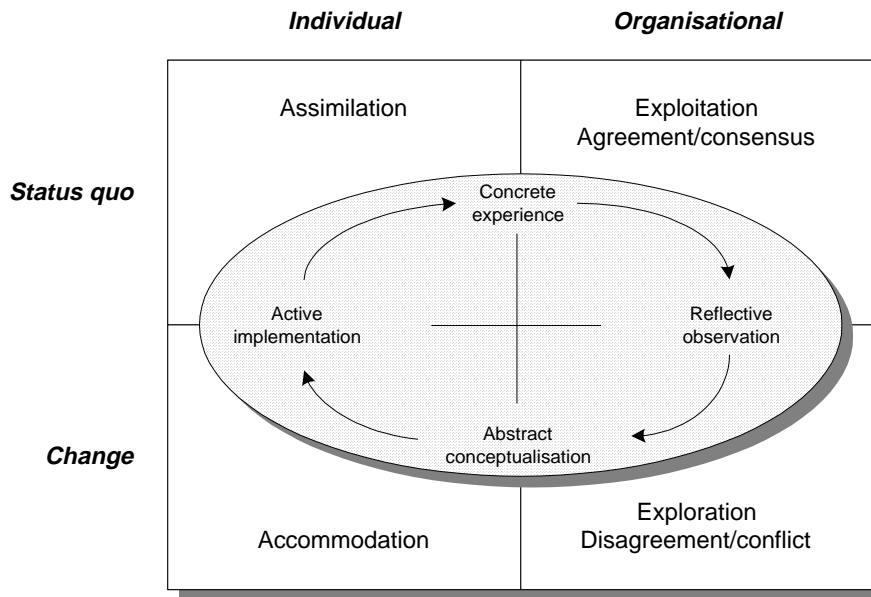


Figure 4
The centrality of balance

5. The strategic learning cycle

If we apply the preceding theoretical propositions to the area of strategic management, the strategic learning cycle, shown in figure 5, results. Mental models are the result of people's background, education and experience (within any organisation and mostly during their entire lifetime). Some mental models are strictly personal, others are widely shared among organisational members. Mental models are important as they determine what kind of data is collected, which methods and techniques are used to analyse the data as well as how the outcomes of the analyses are interpreted. In guiding organisational perception and interpretation, organisational mental models are, amongst other things, the basis on

which people within the organisation, implicitly or explicitly, construe the images they hold of the future. These future images highly influence the strategies that are formulated and the strategic decisions that are taken. After implementing these strategies and decisions, the strategic learning cycle ends if the results are interpreted and evaluated.

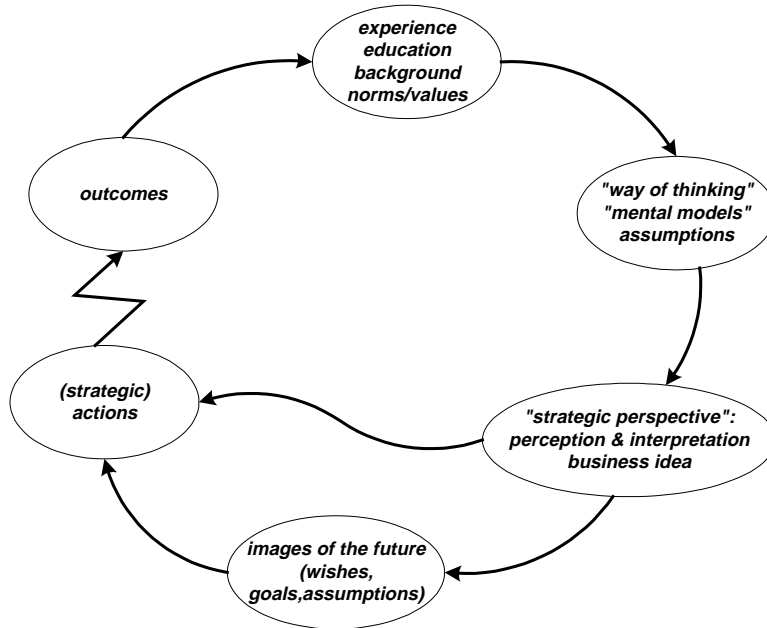


Figure 5
The strategic learning cycle

Bottlenecks to strategic learning

Close inspection of the strategic learning cycle elucidates three other bottlenecks that, besides the cognitive inertia mentioned in the preceding section, may seriously hinder learning within strategic management. The first bottleneck is reflected in the time that elapses between the moment a strategy is formulated and the results of its implementation become perceptible. Given the fact that learning is

a cyclical process during which the results of actions are evaluated (cf. Kolb, 1974; see also Hedberg, 1981), learning will, in general, be more effective the shorter the time lag is between an action taken and the consequences that action produces. Within the area of strategic management this period is often relatively long; it varies somewhere between a few months and more than a decade. Owing to this 'feedback lag', and because strategies are during their implementation continually adapted to changed circumstances, it is uncommonly difficult to link the consequences of a strategy to the originally formulated strategy. As managers can at best only partially trace the outcomes of strategic actions back to their intentions behind those actions, concrete experiences will certainly be biased. Perception and interpretation of outcomes are strongly influenced by expectations proceeding from existing mental models. What happens is that assimilation gets the upper hand and in doing so constrains the learning process. As a result learning on a strategic level is far from effective and mental models are sooner affirmed than enfeebled and modified. A heuristic that illustrates the foregoing process well is 'hindsight': people have an inclination to ascribe successes to their own efforts while they blame disappointing results to factors that lie outside their sphere of influence (Kahneman et al., 1982).

Two other potential bottlenecks for effective learning in strategic management are either the lack or the existence of differences between the mental models of the members of a management-team. If major differences between the mental models are totally lacking, the danger of groupthink lurks. Because assimilation will dominate the learning process at the expense of accommodation, the imaginative faculty of the management-team will narrow too much. As one of the consequences, exploitation of familiar alternatives will overrule the exploration of the unknown. A high degree of perceptual constriction is undesirable because the unknown may be of the greatest importance for a company's survival.

The opposite situation may also hinder the effectiveness of learning in strategic management. Due to differences in background, education, experience as well as current position and speciality, considerable differences in content may exist between the mental models of managers. In consequence of this, reaching agreement may be hard and surrounded with political problems. It may then even take several years before a strategic decision is finally taken (cf. e.g., Hickson et

al., 1986). A recent study by Galbraith and Merrill (1996) shows that organisational politics may even extend to forecasting itself and affect its content.

Advantages of variety

The strategic learning cycle also points to several advantages of having a certain variety in the mental models within a management-team. If the mental models differ, a management-team looks from different perspectives at the environment and the future. Calling back in memory figure 2, this means that both more and different factors and developments are perceived and taken into consideration when preparing strategic decisions and developing strategies. The 'potential coverage' of the mental models is large in such a situation (cf. Walsh et al., 1988). Taken together, they potentially cover a lot of ground. This has a number of advantages. First of all, following Kolb's (1974) learning cycle, as differences between mental models often reflect differences in skills, it is favourable for the effectiveness of learning in management-teams. It is also favourable for the identification of relevant factors, trends and developments. Furthermore, following Fiol (1994) a certain extent of disagreement is essential for corporate innovation as more variation in the content of mental models offers better prospects for building robust relations.

A final advantage concerns the stimulation of creativity as people with different outlooks communicate and debate with each other to explore each others views instead of exploiting their own (De Bono, 1987). Creativity originates as the mental models of different people incorporate each other, a cognitive activity Piaget (1936) denotes as 'reciprocal assimilation'. Reciprocal assimilation may lead to adaptation of existing mental models and creation of new ones, which enable a better accommodation to novelties in the environment. In turn, sooner or later the accommodation to the novelties is extended into assimilation as interest in the new is a matter of reconciling new experiences with old ones. Consequently, accommodation and assimilation enter into a process of mutual interdependence and complement each other. Ideally, a balance between assimilation and accommodation, necessary for effective learning, results. This of course only happens if the mental models do not differ so much that communication is hindered or blocked.

6. The action of scenarios

In the preceding sections we have identified four bottlenecks that may hinder (organisational) learning on a strategic level. First, on an individual level, people exhibit cognitive inertia. In response to observed discrepancies between their observations and their mental models, they change their mental models only gradually or not at all. Second, due to the large timespan that elapses between a strategic action and its result a feedback lag can impede organisational learning. Finally, on a group level, while a balance between the two is important, either too much agreement or too much disagreement between the members of a management-team may interfere with strategic learning. As we will show with the help of the strategic learning cycle, scenarios seem to remove the noticed bottlenecks and in doing so support strategic learning and fulfil the wide range of functions ascribed to them (see figure 6).

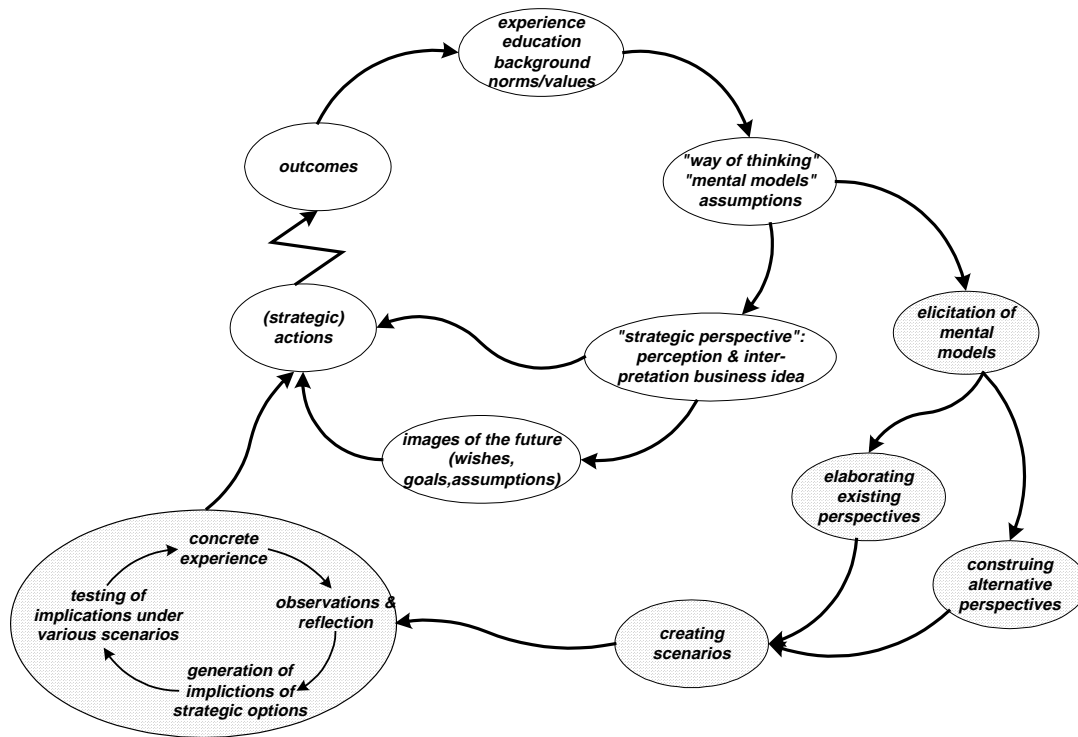


Figure 6
How multiple scenario analysis reinforces strategic learning

Elicitation of mental models

Central in our discussion thus far have been the mental models managers carry with them in their heads and which guide their perception and interpretation. Both small and large differences between the mental models of different managers can potentially undermine effective strategic learning as respectively assimilation and accommodation dominates the strategy formulation process. Therefore, the mental models of the managers involved should be the prime focus of a scenario analysis.

Successful scenario studies, implicitly or explicitly, initially concentrate on eliciting managerial knowledge as varied as underlying norms and values, cultural beliefs, entrenched personal and corporate convictions, taken-for-granted assumptions, etc. In particular the scenario variables denoted by managers as 'constant' or 'predetermined' require attention. Entrenched convictions and taken-for-granted assumptions may be examined by entering these variables as uncertainties into a scenario-analysis.

Although several authors stress the importance of mental models, hardly any one of them pays attention to this, in our view, crucial stage of elicitation. A recent book on the process of scenario analysis by Van der Heijden (1996) is a welcome exception to this observation. Many techniques are currently available for systematically eliciting managerial knowledge; lately they are increasingly referred to as cognitive mapping techniques (Huff, 1990). Simple techniques include interviewing managers, organizing group discussions and studying reports and memos. Alternatively and slightly more complex, approaches like soft systems methodology (Checkland and Scholes, 1990) or software as developed by Colin Eden named Decision Explorer (formerly COPE) may, for example, be used in this stage (Eden, 1989).

From perspectives to scenarios

However managerial knowledge is elicited, a scenario study has to reveal if any differences between the mental models of different managers exist and, if so, which differences and similarities are present and significant. This is quite essential as the character of the scenario analysis is, or should be, largely dependent on the outcome of this analysis. If, on the one hand, considerable mental discrepancies exist between managers, the scenario analysis could focus on increasing agreement between managers (cf. Tenaglia and Noonan, 1992). Because the potential coverage of the mental models is often large in such situations, offering new perspectives is superfluous (unless some important factors and developments are still under-exposed). Management probably benefits more from trying to reach consensus than to introduce new uncertainties. Scenarios may function as negotiative devices facilitating communication and negotiation between managers

with deviating perspectives (Eden, 1987). Each scenario may, for example, make a major and/or extreme managerial future image explicit and open for discussion.

If, on the other hand, significant differences between the mental models are absent too much consensus and, ultimately, the danger of groupthink lies in wait. What happens is that managers quickly assimilate environmental changes and events and in doing so mentally deny the existence of any future uncertainty or hazards. In such critical situations it may be advantageous, if not necessary for the survival of an organisation, to artificially introduce challenging perspectives that reflect significant mental differences and uncertainties. This can be done in several ways, for example, by organizing a 'dialectical inquiry' or by letting someone play the role of 'devil's advocate' (Mason and Mittrof, 1981). Multiple scenario analysis is, in certain ways, closely related to this kind of techniques. In particular because of its strong future orientation and its capabilities for exploration multiple scenario analysis is particularly suitable for long-term, strategic decision-making.

Alternative perspectives may introduce unfamiliar concepts, examine new themes, emphasise developments not (yet) qualified by managers as important or even turn take-for-granted assumptions into uncertainties. Next, on basis of these perspectives alternative scenarios can be construed that contrasts with prevailing images of the future. The idea behind scenario analysis is to make a coherent set of mental models explicit in a scenario. Each of the scenarios therefore present an alternative future picture outside the managers' imaginative faculty. (Note that this also applies to the opposite case wherein the managers' mental models differ significantly.) The scenarios offer an exquisite way to explore what is partially or wholly unknown.

The use of scenarios

Although construing or explicating alternative scenarios will in itself certainly stimulate organisational learning, their true value for triggering and accelerating organisational learning appears when they are actually used in strategic decision-making. By confronting managers with some other perspectives and painting other possible future images, scenarios point managers to unfamiliar factors and developments or make them aware of environmental uncertainties. Scenarios offer the possibility to re-perceive the world around them (Wack, 1985a/b) and use it as a

test-bed for strategy development (Van der Heijden, 1996). As a result, they may fathom that some factors and developments can work out in quite another way than they had thought so far. The purpose is “to fumble at the managers’ eye-flaps” and enlarge their imaginative faculty. Judging from the scenario literature it is in these situations that the real strengths of scenario analysis appear to their full advantage. Recall the fourth and fifth functions of scenarios we distinguished in section 2: making managers aware of environmental uncertainties and stretching managers’ mental models respectively. Put in Piaget’s terminology, scenarios stimulate accommodation and decrease assimilative pressure by offering images that confront with their current mental models. In other words, scenarios potentially decrease managers’ inherent cognitive inertia, one of the four bottlenecks we identified.

Moreover, by offering the possibility to mentally simulate the future and gain concrete experience in a short period, scenarios shorten the feedback lag considerably. Each scenario contains a hypothetical but explicit future image that can be used to discuss and think out the consequences of strategic options. As there are important differences between reading a book about Paris and going there, scenarios offer a different kind of experience than does real life. What is ‘concrete’ about the experiences gained through the use of scenarios is the direct confrontation managers have with (a) their own limited view of the world and their own (biased) mental models, and (b) opinions and expectations of other organisational members.

Organisational learning is above all a social process, wherein managers learn and develop mental models together (Nonaka, 1994). Crucial in the process of organisational learning are successive rounds of dialogue between organisational members. Several authors stress the importance of these dialogues. Duncan and Weiss (1979) characterise this necessary phase as ‘organisational inquiry’, Schön (1983) speaks of ‘rumour and conflict’ while Van der Heijden and Eden (1997) refer to it as ‘strategic conversation’. During the dialogues managers exchange individually acquired mental models, test the mental models they are confronted with, negotiate with other members and develop new mental models from this confrontation. Scenarios provide them with a suitable context for such social dialogues and, thus, for the exchange and accommodation of mental models. In

addition dialogues allow for the exchange of both tacit and explicit knowledge. This is important because, as Nonaka (1994) points out, the mere exchange of information is often useless as it is abstracted from the emotions and feelings that are highly intertwined with it. A large part of our knowledge is tacit and for that reason knowledge is difficult if not impossible to communicate verbally.

Some practical considerations

Note that organisational learning with scenarios does not require that the scenarios (together) give a *representative* description of whatever is possible in the future. Neither do the scenarios have to describe what is most *probable*. Since nobody knows the future, nobody can tell what is the best forecast in the sense of what is going to happen. Compare this for example with judging colours (a metaphor): you do not have to compare the colour of your neighbours' house with every other colour in the spectrum to see how shouting yellow he has painted it. Nor can any comparison fully tell you what the 'best' yellow is (which is different from the yellow you like best). Not so much the future is relevant as managers' mental attitude towards it. Scenarios are for that reason probably good substitutes for real life when they touch some central thoughts and concerns managers have - their 'microcosms' as Wack (1985b) calls it - in such a way that they literally start thinking and learning. By thoughtfully confronting them with another perspective and a way of reasoning that contrasts with their own view of the world, they see where they are standing themselves in relation to other presumptions.

As people tend to be quite stubborn in holding on to their own thoughts, effective scenarios have to be challenging or sometimes even shocking to managers (Schoemaker, 1993). Alternative perspectives have to diverge sufficiently from the current way of thinking in order to evoke discussion and thought. However, alternative perspectives can only diverge from prevailing opinions and assumptions within certain boundaries. If scenarios are too remote from the managers' way of thinking and/or written in another cultural 'language', managers may label them as unbelievable and irrelevant. Van der Heijden (1996) adds to this that the alternative strategies managers compare should be feasible in each of the scenarios. To find the equilibrium between accommodation and assimilation necessary for (organisational) learning to take place, a balance has to be found between

provoking and acceptance. It is probably for this reason that the involvement of managers in the construction of scenarios itself is often stressed as important, especially to link up with their way of thinking and speaking.

7. Conclusions and discussion

We wrote this paper with the purpose to unravel some of the mysteries surrounding multiple scenario analysis in order to determine how it can be used (more) effectively within strategic management. In particular we wondered how a seemingly plain methodology can fulfil a wide range of functions ascribed to it. After classifying and shortly describing these functions we noticed that the most recent ones all circle around the mental models of managers. For this reason we took a cognitive perspective to investigate multiple scenario analysis. By studying the learning that takes place within strategic management both with and without scenarios, we found that scenarios can deal effectively with four bottlenecks that potentially hinder strategic learning.

Removing bottlenecks to learning

First, both by presenting managers deviating images and a possibility to gain shared experiences, multiple scenario analysis enhances exploration of the unknown and in this way stimulates accommodation of their mental models. In doing so, scenarios help people overcome their inherent cognitive inertia. Second, by offering them a context wherein they can rehearse the future and ex ante overthink the consequences of strategic options, scenario analysis artificially reduces the feedback lag which in reality retards strategic learning considerably. In this way it accelerates (organisational) learning. Third and fourth, scenario analysis appears to enclose the means to deal effectively with both situations of strong agreement and disagreement between the members of a management-team or an organisation. If the (relevant) mental models of different managers are carefully elicited, it can shield organisations from the danger of groupthink and paralysis due to dissension respectively.

Looking over these results, the crux of multiple scenario analysis appears to lie in the fact that scenarios simultaneously challenge current ways of thinking and offer a context to deal with the tension that follows from that challenge. In doing so, multiple scenario analysis offers possibilities for finding a balance between the closely related processes of exploitation and exploration, assimilation and accommodation and agreement and disagreement. As explained in this paper, balancing these terms is mediated by effective organisational learning and important for organisations to survive and prosper.

Stimulating creativity

Scenario analysis puts managers in the centre of analysis and focuses on how they think about the world around them; the world itself only comes in second place. Compare this with the 'traditional' strategic management techniques, like the SWOT-analysis and portfolio-analysis, that aim to reduce environmental complexity and uncertainty by modeling the environment in often simple, familiar terms. The premise of these techniques is that the more careful and systematic managers analyse the complex and uncertain environment, the more successful the strategies they formulate will be. Note that most if not all traditional strategic management techniques deal with the past and at best with the current. Moreover, as Mintzberg (1994) has pointed out, as these techniques fully rely on analysis they will, by definition, fail in formulating successful strategies which requires exploration and the creative synthesis of knowledge and surprising insights. Multiple scenario analysis offers ample space for the latter, in particular during the dialogues that will take place between organisational members when using scenarios.

Facilitating organisational learning

Multiple scenario analysis aims at making managers aware of their limited cognitive capabilities. By presenting alternative stories as valid ways of thinking, scenarios show them how biased and subjective their perceptions and opinions are. Meanwhile, the set of scenarios indicate that the future is probably much more uncertain as they thought. The mere (conscious) confrontation with deviating perspectives sets off a learning process as managers will try to incorporate these perspectives into their existing mental models and/or change these models. In other words, they enter into a process of accommodation and assimilation. In contrast to 'real life learning' such a learning process can be guided as the scenarios are construed by organisational members. In this respect, because scenarios offer a context wherein managers can learn together by discussing and simulating the future, they can be conceived as a way of learning by experimentation. In this way scenarios facilitate communication and negotiation between managers with deviating perspectives.

Improving scenario analysis

Besides unravelling some of the mysteries surrounding scenario analysis, our analysis of the action of scenarios highlights a number of practical issues that can improve a scenario analysis and contribute to its effectiveness. First, any scenario analysis should start with charting managers' mental models. Scenarios should focus on their way of thinking, not on what, for example, some strategic planner or consultant thinks is important. As mentioned there are several ways to chart mental models. Second, like it is impossible to pull yourself out of a swamp, identifying entrenched corporate convictions and organisational cognitive biases by introspection is impossible. For this reason any scenario-team should have some outsiders besides some (internal) managers. Recall that the latter are necessary to ensure the construed scenarios link up with the cultural language of the organisation. Thirdly, scenario-teams should change regularly to prevent that routines grow for construing scenarios. Scenarios are precisely construed to attack routines and habits. If we take this one step further, organisations that are working with scenarios for a long time may even have to consider to drop scenario analysis

as its managers may have developed routines to 'deal' with challenging scenarios effectively!

In closing, although multiple scenario analysis is currently chiefly employed by large multinational companies, we are convinced it is as useful for small and medium-sized enterprises. For one thing, scenario analysis offers a more dynamic and realistic context for strategy development than the traditional way of strategic planning (cf. Mintzberg, 1994). Given limited resources and management-time, adapting scenario analysis to smaller companies will undoubtedly have some consequences for the design of a scenario study. This holds a promising challenge for both academics and managers/consultants alike.

References

- Beck, P.W. (1982) Corporate planning for an uncertain future. *Long Range Planning*, **15** 12-21.
- Bunn, D. W., and Salo, A.A. (1993), Forecasting with scenarios. *European Journal of Operational Research*, **68**, 291-303.
- Checkland, P., and Scholes, J. (1990) *Soft systems methodology in Action*. Wiley, Chichester.
- De Geus, A.P. (1988) Planning as learning. *Harvard Business Review* March-April, 70-74.
- De Bono, E. (1987) *Letters to thinkers, further thoughts on lateral thinking*. Penguin Books, London.
- Duncan, R., and Weiss, A. (1979) Organizational learning: Implications for organizational design, In *Research in organizational behavior*, ed. B. Staw, **1**, 75-123. JAI Press, Greenwich, CT.
- Eden, C. (1989) Using cognitive mapping for strategic options development and analysis (SODA), In *Rational analysis for a problematic world*. ed. J. Rosenhead, 21-42. Wiley, Chichester.
- Eden, C. (1992) Strategy development as a social process *Journal of Management Studies* **29**, 6, 799-811.
- Fiol, C.M. (1994), Consensus, diversity, and learning in organizations, *Organization Science*, **5**, 3, 403-420
- Flavell, J.H., P.H. Miller, and S. Miller (1993) *Cognitive development* (3rd ed.). New Jersey: Prentice-Hall, Englewood Cliffs.
- Galbraith, C.S., and G.B. Merrill (1996) The politics of forecasting: Managing the truth. *California Management Review*, **38**, 2, 29-43.
- Gioia, D.A., and P.P. Poole (1984) Scripts in organizational behaviour. *Academy of Management Review* **26**, 4, 417-438.
- Godet, M. (1982) From forecasting to 'La Prospective': A new way of looking at futures. *Journal of Forecasting*, **1**, 3: 293-301.
- Godet, M. (1987) *Scenarios and strategic management*. Butterworths Scientific, London.

- Grayson, L.E. (1987) *Who and how in planning for large companies*. Basingstoke: MacMillan.
- Hedberg, B. (1981) How organizations learn and unlearn in *Handbook of organizational design* eds. P.C. Nystrom and W.H. Starbuck, 8-27, University Press, London.
- Hickson, D.J., R.J. Butler, D. Cray, G.R. Mallory, and D.C. Wilson (1986) *Top decisions: strategic decision making in organizations*. Basil Blackwell: Oxford.
- Hooley, G.J. (1984) The implementation of strategic marketing planning techniques in British industry. *International Journal of Research in Marketing*, **1**, 153-162
- Huff, A.S. (1982) Industry influence on strategy reformulation. *Strategic Management Journal*, **3**, 119-131.
- Huss, W.R. (1988) A move toward scenario analysis. *International Journal of Forecasting*, **4**, 377-388.
- Janis, I.L. (1972) *Victims of groupthink*, Houghton Mifflin, Boston.
- Jungerman, H. (1985) Inferential processes in the construction of scenarios. *Journal of Forecasting*, **4**, 321-327.
- Jungerman, H., and M. Thüring (1987) The use of mental models for generating scenarios. In *Judgmental forecasting*, Eds. G. Wright and P. Ayton, 245-266, Wiley, Chichester.
- Kahn, H., and A. Wiener (1967) *The year 2000*, MacMillan: New York.
- Kahneman, D., P. Slovic, and A. Tversky, editors (1982) *Judgment under uncertainty: Heuristics and biases*. Cambridge University Press, Cambridge.
- Kiesler, S., and L. Sproull (1982) Managerial response to changing environments: Perspectives on problem sensing from social cognition. *Administrative Science Quarterly*, **26**, 548-570.
- Kolb, D.A. (1974) Learning and problem solving: On management and the learning process. in *Organizational psychology: An experiential approach*, 2nd ed.. eds. D.A. Kolb, I.M. Rubin and J.M. McIntyre. Prentice Hall, Englewood Cliffs: NJ.

- Leemhuis, J.P. (1985) Using scenarios to develop strategies. *Long Range Planning*, **18**, 2, 30-37.
- Linneman, R.E., and H.E. Klein (1983) The use of multiple scenarios by U.S. industrial companies: A comparison study, 1977-1981. *Long Range Planning*, **16**, 6, 94-101.
- Malaska, P. (1985) Multiple scenario approach and strategic behaviour in European companies. *Strategic Management Journal*, **6**, 339-355.
- March, J.G. (1991), Exploration and exploitation in organizational learning, *Organization Science*, **1**, 2, 71-86
- March, J.G., and H.A. Simon (1958), *Organizations*, London: Wiley.
- Mason, R.O., and I.I. Mitroff (1981) *Challenging strategic planning assumptions; Theory, Cases and Techniques*. Wiley, New York.
- Miller, G.A. (1956) The magic number seven plus or minus two: Some limits on our capacity for processing information. *Psychological Review*, **64**, 81-97.
- Millett, S.M. (1988) How scenarios trigger strategic thinking. *Long Range Planning*, **21**, 61-68.
- Mintzberg, H. (1994) *The rise and fall of strategic planning*. Prentice Hall, Englewood Cliffs, NJ.
- Nonaka, I. (1994) A dynamic theory of organizational knowledge creation. *Organization Science*, **5**, 1, 14-37.
- Pascale, R.T., and A.G. Athos (1981) *The art of Japanese management*. Simon and Schuster, New York.
- Piaget, J. (1936) The origins of intelligence in children, In *The essential Piaget: An interpretive reference and guide*. eds. H.E. Gruber and J.J. Vonèche, 215-149. Basic Books, New York.
- Piaget, J. (1937) The construction of reality in the child, In *The essential Piaget: An interpretive reference and guide*. eds. H.E. Gruber and J.J. Vonèche, 250-294. Basic Books, New York.
- Porter, M.E. (1985) *Competitive advantage*, The Free Press, New York.
- Raubitschek, R.S. (1988) Multiple scenario analysis and business planning' In *Advances in strategic management*. eds. R. Lamb and P. Shrivastava, **5**, 181-205. JAI Press, Greenwich, CT.

- Reibnitz, U. von (1988) *Scenario techniques*. McGraw-Hill, Hamburg.
- Schnaars, S.P. (1987) How to develop and use scenarios. *Long Range Planning* **20**, 1, 105-114.
- Schoemaker, P.J.H. (1993) Multiple scenario development: Its conceptual and behavioral foundation. *Strategic Management Journal* **14**, 193-213.
- Schoemaker, P.J.H., and C.A.J.M. van der Heijden (1992) Integrating scenarios into strategic planning at Royal Dutch/Shell. *Planning Review* **20**, 3, 41-48.
- Schön, D.A. (1983) Organizational learning In *Beyond method: Strategies for social research*. ed. G. Morgan, 114-128. SAGE, Beverly Hills.
- Schwartz, B. (1988) Forecasting and scenarios In *Handbook of systems analysis*. eds. H.J. Miser and E.S. Quade, 327-367. Wiley, Chichester.
- Schwartz, P. (1991) *The art of the long view: Planning for the future in an uncertain world*. Doubleday Currency, New York.
- Stubbart, C.I. (1989) Managerial cognition: A missing link in strategic management research. *Journal of Management Studies*, **26**, 325-347.
- Tenaglia, M., and P. Noonan (1992) Scenario-based strategic planning: A process for building top-management consensus. *Planning Review* **20**, 3, 12-19.
- Van der Heijden, K. (1996) *Scenarios: The art of strategic conversation*. Wiley, Chichester.
- Van der Heijden, K., and C. Eden (1997) Managerial cognition, organizational cognition and the practice of organizational learning In *Managerial and organizational cognition: New directions in theory, methods and research*. eds. C. Eden and J.C. Spender. SAGE Publications, Newbury Park (forthcoming).
- Wack, P. (1985a) Scenarios: Unchartered waters ahead. *Harvard Business Review*, Sept.-Oct.: 73-89.
- Wack, P. (1985b) Scenarios: Shooting the rapids. *Harvard Business Review*, Nov.-Dec.: 139-150.
- Walsh, J.P., C.M. Henderson, and J. Deighton (1988) Negotiated belief structures and decision performance: An empirical investigation. *Organizational Behavior and Human Decision Processes*, **42**, 194-216.

Weick, K.E. (1979) *The social psychology of organizing*. Random House, New York.