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Strategic Evolution in Highly Complex Realities: Corporate Level Strategy in the Situation of a Merger

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Complex realities are a tremendous challenge for firms, internally as well as externally. Due to a reductionist tradition of thinking and modeling, these complexities are underestimated in strategy theory. In this article, we claim that modern evolutionary theories have an elaborate understanding of complex adaptive systems and are therefore able to provide new building blocks to a more realistic strategy paradigm that helps to understand and explain a firm's strategic behavior in its highly complex competitive and societal context. In the first part of this paper, we develop three general principles of complexity on the grounds of modern biological evolutionary theory. These principles concern the three forms of complexity, that is hierarchical complexity, functional complexity, and layer complexity. In the second part of this article, these principles are applied to corporate-level strategy as illustrated by a merger situation. Phenomena as complex as mergers, especially mega-mergers, offer so many possible dimensions of causalities that a rich frame of thinking such as evolutionary theory is essential for a comprehensive understanding of a real-life situation. This evolutionary analysis of a merger leads to a deeper understanding of the nature of corporate strategy in complex realities and confirms the analytical power of frameworks of strategic thinking based on complexity theory.

DYNAMIC PERSPECTIVES OF COMPLEXITY IN STRATEGY THEORY

Complexity from a dynamic perspective has, to date, been discussed mostly within two streams of research in strategy theory, namely in population ecology and in the complex system perspective of strategy. Two schools of thought have gained importance in population ecology. They distinguish between intraorganizational (see *Strategic Management Journal,* 1996) and extraorganizational (see Baum, 1996) evolution. Baum and Singh (1994) advanced this development by editing a collection of articles. For managerial purposes, intraorganizational population ecology seems to be more useful in grappling with complexity than in extraorganizational population ecology, as it also emphasizes the importance of internal variation and selection. «[V]ariation derives from managers' initiatives competing for limited resources, selection is exerted through corporate context mechanisms

governing resource allocation, and retention takes the form of corporate strategy which defines the areas in which the firm has learned it can operate successfully» (Burgelman and Mittman, 1994: 54). Recent research in intraorganizational population ecology is focused on the interaction between top and middle management. Empirical analyses contrasting emergent bottom-up processes of strategy formulation with the top-down processes of the planning design school (Burgelman, 1991; Doz, 1996; Noda and Bower, 1996) emphasize the central role played by middle management. These studies, however, are mainly descriptive and require more theoretical foundation (Amburgey and Rao, 1996) before they can be used to formulate principles of action.

The complex system perspective on strategy is based on the complexity theory developed mainly at the Santa Fe Institute (e.g., Kauffman, 1993; Arthur, 1994; Holland, 1995). It studies complex adaptive systems (CAS) with the features of bounded rationality, self-organization and the behaviour in a zone outside equilibrium (Nonaka, 1988; 1995; Stacey, 1996; Beinhocker, 1997). Macintosh and Maclean (1999) call this approach the “edge of chaos” view of complexity theory as it focusses on a constant adaptational movement by the organisation to the optimal position of an organisation between order and chaos. We have adopted this concept since it seems well suited to dealing with the merger situation, which is seen as just one step in a sequence of strategic events in a context of ongoing disequilibrium. The authors mention another concept of complexity theory: “the dissipative structures view”. Since this concept focusses on the sequence of “stability, chaos and new stability”, it seems less suited to analyzing a situation of ongoing disequilibrium. To date, neither of the two perspectives on strategic change has touched on work in the realm of evolutionary theory in an elaborate way. However, Brown and Eisenhardt (1997) have combined the two perspectives on a pragmatic level by incorporating both complexity theory and time-paced evolution (see also Gersick, 1991). To a certain extent, they have followed developments in the field of modern biological evolutionary theory, which integrates Darwinism and complexity theory as developed by the Santa Fe Institute (Kauffman, 1993; 1995; Bascompte and Solé, 1995). This approach, in a more fundamental perspective, seems promising in deepening our understanding of corporate-level strategy in complex realities. We will therefore proceed by first outlining modern biological evolutionary theory as it lends itself to providing the fundamental body of knowledge necessary for our purposes.

MODERN BIOLOGICAL EVOLUTIONARY THEORY AS AN ADVANCED FOUNDATION OF COMPLEXITY IN STRATEGY THEORY

We claim that modern biological evolutionary theory can substantially contribute to current strategy theory and help firms to address the challenges with which they are confronted in today’s complex realities.

In doing so, we must be aware that the use of natural science knowledge and especially of biological evolutionary theory in understanding and explaining social realities is often criticized. This critique may be justified to a certain extent if this knowledge is used as an analogy (see e.g., Campbell, 1969; Witt, 1997). Nevertheless, we think that the modern biological evolutionary theory has a high potential in explaining social realities if one considers the general principles behind biological evolutionary mechanisms instead of analogies. We refer to Richard Dawkins, one of today's most prominent evolutionary thinkers: «Cultural 'evolution' is not really evolution at all if we are being fussy and purist about our use of words, but there may be enough in common between them to justify some comparison of principles» (Dawkins, 1986: 216).

General principles allow a deeper understanding of evolutionary mechanisms while avoiding the traps of analogies that neglect the differences between biological and human social systems. John Holland, a computer scientist connected to the Santa Fe Institute, has this to say on the topic:

«Many of our most troubling long-range problems—trade balances, sustainability, AIDS, genetic defects, mental health, computer viruses—center on certain systems of extraordinary complexity. The systems that host these problems—economies, ecologies, immune systems, embryos, nervous systems, computer networks—appear to be as diverse as the problems. Despite appearances, however, the systems do share significant characteristics, so much so that we group them under a single classification at the Santa Fe Institute, calling them complex adaptive systems (CAS). This is more than terminology. It signals our intuition that there are general principles that govern all CAS behavior, principles that point to ways of solving the attendant problems.» (Holland, cited in Horgan, 1995: 75)

We claim that modern biological evolutionary theory can provide insight into what such general principles are.

A central topic in biological evolutionary theory is the development of complexity (see e.g., Dawkins, 1986; Bonner, 1988). In this theory, complexity is regarded from both a functional and hierarchical perspective. Functional complexity is explained by variation and selection processes: more simple organisms (e.g., eukaryotes) evolve to complex ones (e.g., mammals) (see e.g., Maynard Smith and Szathmàry, 1995). Progress itself is not the topic; it is instead the explanation of life and its complex organisms, which, according to Dawkins, are produced by cumulative natural selection that occurs gradually (Dawkins, 1986). Maynard Smith (1986b) provides support for this argument in pointing out that structures are modified to new functions within variation and selection processes.

Complexity can be explained not only functionally but hierarchically. In the micro and macro debate, modern biological evolutionary theory contributes to the understanding of multilevel evolution (see Eldredge, 1995). This multilevel approach also helps in understanding complex adaptive systems by emphasizing the emergent interrelatedness of the different levels.

We therefore consider both functional and hierarchical complexity along with a further form of complexity, namely layer complexity, which we will explain later. As these complexities are intertwined, we will focus on the different levels of modern biological evolutionary theory in demonstrating its importance for developing basic evolutionary principles enhancing the understanding of complex adaptive systems.

EVOLUTION AT THE GENE AND MEME LEVEL

Extensive discussions among biological evolutionary theorists have concerned the different levels of analysis of evolutionary systems. A first level of analysis is the gene level originally taken into account by the synthetic theory (e.g., Fisher, 1930; Dobzhansky, 1937; Mayr, 1991). It was based on the knowledge about genes and rules of inheritance developed by Augustine Weismann and Gregor Mendel. This so-called micro-perspective of evolutionary biological theory has been further developed by the ultra-Darwinians (e.g., Dawkins, 1982; 1989; Maynard Smith, 1989; Williams, 1992). According to their view, evolution takes place as a consequence of the existence of replicating entities that strive for reproductive success. The principle holds true with any kind of replicator and macro-evolution therefore depends on micro-evolution (Plotkin, 1994). Dawkins even goes so far as to describe organisms as nothing more than survival machines in the service of "selfish" genes (Dawkins, 1989). From this point of view genes appear to be quasi-immortal; the entity can die without jeopardizing the evolutionary process. Thus, as for Dawkins (1989) and Williams (1992), the important level of analysis is the gene. These replicating entities deal with their changing environments through the processes of variation and selection (Sober, 1984; Williams, 1992). Normally, variation is considered to occur by chance and selection by necessity (e.g., Dawkins, 1986; Mayr, 1991).

These ideas have also been transferred to cultural systems, whereby the notion of memes replaces the notion of genes.

A meme is an idea or, more generally, a communication pattern that can be transmitted (in print or by word of mouth) to other people's minds or to organizational identities (e.g., Dawkins, 1989; Moritz, 1990; Dennett, 1995). It is, in other words, a replicator. It is a replicator of cultural systems that reproduces, not by copulation, but by any kind of communication. Those memes will survive and be replicated over generations that are more learnable, more easily communicated and have a higher tendency to be transmitted than others. The notion of memes is crucial when we turn to the analysis of the strategic evolution of firms as a special form of social systems. Variation and selection based on memes correspond to the processes we mentioned for genes.

EVOLUTION AT THE ENTITY LEVEL

The "survival machines" of selfish genes, or the entities (Dawkins, 1989), mentioned above develop a special kind of identity over time

(Maturana and Varela, 1987). Entities must therefore have the capability not only to adapt, but also to develop and to preserve their identity in order to survive. The more an organism reaches a certain degree of complexity and the more its identity is developed in the process, the better it is able to gain a certain autonomy with respect to its environment. Modern biological evolutionary theory is thus based on identity preservation and adaptation at the entity level (Maturana and Varela, 1987). If the entity has an identity, the focus of analysis can not be only at the gene level, but must also take the entity level into account. To explain adaptation, one can refer to natural selection theory but identity preservation calls for another explanation, which can be found in Maturana and Varela's (1987) so-called autopoiesis concept or in Kauffmann's (1993) spontaneous self-organization concept.

According to Maturana and Varela (1987), the entity is only partly open to its environment. To disassociate itself from the environment, an entity must create and preserve its identity by operational closedness. Varela (1984) observed that, once the closure of a system is achieved, it automatically takes care of its own internal coherence. Changes in structures are specified by the system itself and constrained by the system's identity. According to this concept, complexity can arise inside the entity as well as in the environment. The more complex an organism and the more highly developed its internal structure is, the more autonomous it will be with respect to its environment. The organism then starts to develop its specific rationality, often called a cognitive plan (Maynard Smith, 1986a), which, in turn, makes internal selection more important. Complex organisms can even direct or purposefully influence selection (Monod, 1970). Thus, even in biological systems, evolution occurs not only by chance or by necessity, as is the common view, but also to a certain extent on purpose. This means that complex organisms can preserve a certain autonomy and do not adapt completely to environmental changes.

With respect to internal structure, the concept of spontaneous self-organization (Waldrop, 1992; Kauffman, 1993) allows for further explanations of an entity's evolution: This approach also claims that variation and selection processes are not sufficient to explain the changes in entities. Changes in entities are also explained by the metaphor of a fitness landscape to which actors adapt, where mountains represent high fitness, valleys low fitness and fitness itself is determined by the number of possible genes that differ in kind, in their combinations and in their interactions. Every given point in the fitness landscape thus represents another composition of these combinations, some of them fitter than others. In a recent article, Levinthal and Warglien (1999) analyzed different landscape structures and their implications for an actor's behaviour along with the tools and consequences of landscape design in the context of self-organization. The concept of fitness landscape as developed in this article goes beyond the metaphoric use and overrides to theoretical and practical insight into the evolution of organizations.

As the entities subject to selection become more complex, external selection becomes a less powerful force. Instead, self-organization

(internal selection) takes place, not because of, but in spite of external selection. In the “edge of chaos” view of complexity theory (Macintosh and Maclean, 1999), self-organizing entities whose behaviour is influenced by the landscape structure therefore purposefully search for the point of highest fitness in the fitness landscape, a process which literally resembles a tightrope walk at the edge of chaos. «Living systems exist in the solid region near the edge of chaos, and natural selection activities achieve and sustain such a poised state» (Kauffman, 1993: 232). Both order and chaos have their specific advantages and disadvantages. Order usually leads to lower costs since, for example, no losses due to uncertainty and double tracking occur. On the other hand, a high level of order is said to lack flexibility and creativity, i.e., it is said to lack efficiency. The opposite is true for chaos. In chaotic situations unneccessary costs occur because of uncertainty and lack of orientation while the freedom of the situation enhances flexibility and creativity and therefore efficiency. In considering the attempt to remain in the solid region near the edge of chaos, the question of an entity’s identity preservation or adaptation becomes salient.

To explain the evolution of entities as complex adaptive systems, we may therefore consider both natural selection theory, highlighting primarily external variation and selection processes, and the concepts of identity preservation and variation and of spontaneous self-organization, emphasizing internal processes of variation and selection.

EVOLUTION AT THE MACRO LEVEL

Apart from evolutionary theories that focus on the gene and the entity level, there exists a macro-perspective of biological evolutionary theory that has been molded mainly by the so-called naturalists (Gould, 1977; Vrba & Eldredge, 1984; Eldredge, 1995). They claim that there are several levels of evolution for which paleontologists have found evidence in fossil records (Eldredge, 1995). The naturalists’ focus of study is the hierarchical structure of biological systems. According to their view, there are processes that are relevant to understanding evolution at each of these levels, which include «the gene level, the organism level, the population level, the species level and the level of the ecosystem» (Eldredge, 1995: 6).

In concentrating on the evolution at the species level and analyzing fossil records, the naturalists have also discovered that, before adapting to a changing environment, a species would rather start to move and look for familiar living conditions elsewhere, which is called habitat tracking (Eldredge, 1995). Again, not only external selection, but self-organization ensures higher fitness and guides species towards the best possible point of fitness at the edge of chaos.

CRITERIA OF SUCCESS: LAYER COMPLEXITY

In contrast to the ultra-Darwinians, Eldredge and Grene (1992) take the view that evolution depends not only on reproductive success, but also on so-called economic success. According to them, organisms

basically do two different things: they reproduce (competition for reproductive success), and they engage in matter-energy processes (competition for economic success) (Eldredge & Salthe, 1984). Based on that view, the naturalists (Eldredge & Salthe, 1984; Vrba & Eldredge, 1984; Eldredge & Grene, 1992; Eldredge, 1995) have developed a framework with two hierarchical systems: a genealogical system that accounts for reproduction and an ecological system with levels that interact by energy flow. For biological complex adaptive system, both the genealogical and the ecological aspects are important as they provide different criteria for fitness and success. This perspective leads to a new dimension of complexity. We call it layer complexity.
Within this concept, complexity arises from the fact that, through the consideration of economic as well as reproductive success, more layers of selection in an evolutionary process become relevant.

BASIC PRINCIPLES OF EVOLUTIONARY THINKING ON COMPLEXITY

Based on the analysis of the recent developments in biological evolutionary theory discussed so far, the following general principles of the evolution of complex adaptive systems can be derived:
Biological evolutionary theory demonstrates that complex adaptive systems evolve not just at one single level, but at different interrelated levels simultaneously.
— The first principle of evolutionary thinking therefore says that in complex adaptive systems evolution takes place simultaneously at several interrelated levels (hierarchical complexity).
The system's hierarchical complexity is not of a static nature, but it is embedded in a continuous process of change that is based on the fundamental mechanisms of evolution. In the transit region between order and disorder at the edge of chaos, the question of identity preservation and adaptation becomes particularly important in the attempt to achieve success.
— The second principle of evolutionary thinking is therefore that internal and external complexity are based on the two main mechanisms of evolution, namely variation and selection. In a complex adaptive system, performing at the best possible level of fitness at the edge of chaos leads either to adaptation or identity preservation at all interrelated levels of evolution. Evolution can happen either by chance, by necessity or on purpose (functional complexity).
Both biological and social evolutionary theory show that changes in adaptive systems are guided by various success or failure criteria. Based on their inherent evolutionary mechanisms, systems reach different degrees of fitness with respect to these criteria.
— The third principle of evolutionary thinking is therefore that multiple causalities on all of the complex adaptive system's interrelated levels influence its fitness with respect to different types of success (layer complexity).

A complex adaptive system's complexity therefore is rooted in hierarchical, functional and layer complexity. The basic evolutionary principles concerning these different types of complexity also apply to a firm's strategic development at corporate level and can provide a deeper understanding of corporate strategic behaviour.

CORPORATE-LEVEL STRATEGY

Corporate-level strategy (Kanter, 1984; 1987; Goold, Campbell, and Alexander, 1994; Hax and Majluf, 1996; Porter, 1996; Collis and Montgomery, 1997) is one of the important factors in the evolution of a firm if that firm is seen as a complex adaptive system. It influences its development to a large extent and therefore also influences its success or failure (Miles and Snow, 1994).
Following Porter's recent argumentation, «strategy is the creation of a unique and valuable position, involving a different set of activities» (Porter, 1996: 68). He points out that the essence of strategic positioning is making trade-offs, that is, differing from one's rivals in one's activities. Examples of corporate-level strategic problems are mergers, acquisitions and alliances (Mueller, 1969; Davidson, 1985; Jemison and Sitkin, 1986; Trautwein, 1990; Walter and Barney, 1990; Haspeslagh and Jemison, 1991; Eisenhardt and Schoonhoven, 1996). Mergers of big firms (mega-mergers) are highly complex corporate-level strategic events that can only be understood from a holistic perspective (Pettigrew, 1990; 1995; Rühli and Sachs, 1999). To a large extent, the fundamental principles of evolution developed in the last paragraph provide just such a holistic perspective.

CORPORATE-LEVEL STRATEGY FROM THE PERSPECTIVE OF HIERARCHICAL COMPLEXITY

Corporate-level strategic moves are often seen as top-management decisions, in which the actors choose among different alternatives, such as mergers, on the grounds of specific market signals. This view represents a reduction to a limited number of linear causalities that bears the danger of not providing an adequate explanation of a complex strategic development in reality. This danger is especially apparent in the case of a mega-merger since it is a strategic move that is based on various hierarchical, functional as well as layer inderdependencies.
In real life, the decision to carry out a strategic move at the corporate level highly depends on the interactions taking place on four additional levels, namely the meme, business, alliance and society levels (Bower and Doz, 1979; Nelson and Winter, 1982; Levinthal, 1994; Miner, 1994; Burgelman, 1996; Klein, Tosi, and Canella, 1999; Sachs and Rühli, 2000).
The basic level of a firm's evolution is the meme level (Sachs, Rühli, and Schmitt, 1997). Core values are the most important component of this level (Tushman and Romanelli, 1985; Collins and Porras, 1994).

They define a firm's enduring character and are inert with respect to changes in their basic tenets, a characteristic that has a tremendous impact on a firm's strategic development at the corporate level. Memes guide the cognitive processes of strategic planning and therefore are driving or buffering factors as to whether a merger will be in the realm of actions open to a firm or not (Barham and Heimer, 1998). However, the relation between the meme level and corporate level is of a reciprocal nature: A merger also influences the core values of a firm by combining and recombining the existing values of two merging firms or, by providing a source of new values, e.g., new top managers, who spread new values throughout the organization and make existing values obsolete.

Additionally, there is the core values' more indirect influence on a firm's strategic development at the corporate level. Core values influence the middle managers' contribution to corporate strategy and, consequently, the strategic outcomes at the corporate level. Core values are, in turn, influenced by middle management, a proposition that has been confirmed by the empirical studies previously mentioned in this article.

Research on corporate culture confirms that a firm's core values and the strategies they produce are also influenced by the values of different actors at the industry and society level (Gordon, 1991; Schneider and de Meyer, 1991; Trice and Beyer, 1993). The levels outlined above are also in a constant interaction with the industry and society levels. The latter may judge mergers positively, which may make stability and successful development possible. However, such approval may also be seen as a negative development leading to undesirable monopolistic situations or loss of jobs. Depending on how a merger is perceived, it leads to either cooperative or competitive situations between a firm and its various (economic as well as societal) stakeholder groups.

One can conclude, from the above description, that in a merger, core values have a multi-dimensional, and often hidden and indirect influence on corporate strategy, partly supporting strategic moves, partly buffering them.

Besides interacting with the meme level, the corporate level also interacts with the business level (Porter, 1987; Goold et al., 1994). Corporations are often multibusiness organizations. Within this structure, the different businesses have a certain autonomy limited and influenced by other organizational levels. Decisions at the business level, such as the choice of a particular business strategy, also have an important impact on the scope of strategic actions at the corporate level. A business-level decision may conflict with a merger decision at the corporate level. In this sense, middle management and its interaction with top management are particularly relevant. As empirical analysis shows (e.g., Noda and Bower, 1996), the importance and function of the middle management in the process of strategy formulation at the corporate level is underestimated in current strategy theory. In fact, corporate strategy formulation is more often a bottom-up process than normally presumed.

A merger is a cooperative strategy employed by formerly independent firms at the corporate level. But the relationship between the two pre-

viously separate firms may be characterized by cooperation at the corporate level and competitive elements at the business level. As a cooperation leads to synergies, some business units may become core businesses with strong core competencies or substantial market power and a high potential for economies of scale. Other business units, however, may be less important and less successful. Because these less successful businesses compete for the same resources as the core businesses, they slow down the whole entity's pace of development. As a consequence, the weaker businesses are often sold (Rühli and Sachs, 1999). A strategic move at the corporate level, such as a merger, therefore strongly influences a firm's business level. But the opposite is also true: Newly formed business units define the limits of future strategic moves at the corporate level. They redefine the middle management's structure of power by influencing the way in which corporate strategies in post-merger periods are developed.

The corporate level is also interconnected with the industry level: An industry's structural development, especially as exemplified by the behavior of important competitors, for instance the way they build alliances, may force an individual firm to follow suit in order to avoid a loss of market or innovation power (Chatterjee, 1986; Nelson, 1995). On the other hand, a merger between two important actors within an industry can change the whole competitive structure in this specific industry as was the case in the pharmaceutical industry, in the telecommunications or in the airline business. Both competitive and cooperative relationships are reconstructed (Grant and Cibin, 1995; Hoffman, 1999).

The same effect can be observed at the society level. As is known from the debate on the political power of multinational corporations, mergers may have a tremendous impact on the society (political) level. On the other hand, society regulates a firm's behavior, for example by takeover regulations or by reinforcing or limiting a firm's merger behavior and therefore its strategic development (Wood and Gray, 1991; Amit and Schoemaker, 1993; Blair, 1995; Sachs and Böhi, 1995). As society normally focuses not on individual firms, but creates general regulations, it has various indirect influences (via the industry, business or core-value levels) on a firm's strategic evolution on each of the five levels mentioned so far. Again, a firm's evolution may include supporting (cooperative) elements and limiting (competitive) influences.

In the example of a merger, understood here as a complex adaptive system's crucial strategic move, our first principle of evolutionary thinking, which stresses hierarchical complexity, leads to a more elaborate understanding of the reciprocal, partly competitive (antagonistic), partly cooperative (harmonious) interactions at the five levels of a firm's evolution. The basic interactions shown below in **Figure 1** could be developed in more detail, providing an even higher degree of complexity.

In applying the hierarchical complexity principle on the merger issue, it becomes evident that success and failure are caused by a large number of interactive and multilevel causalities.

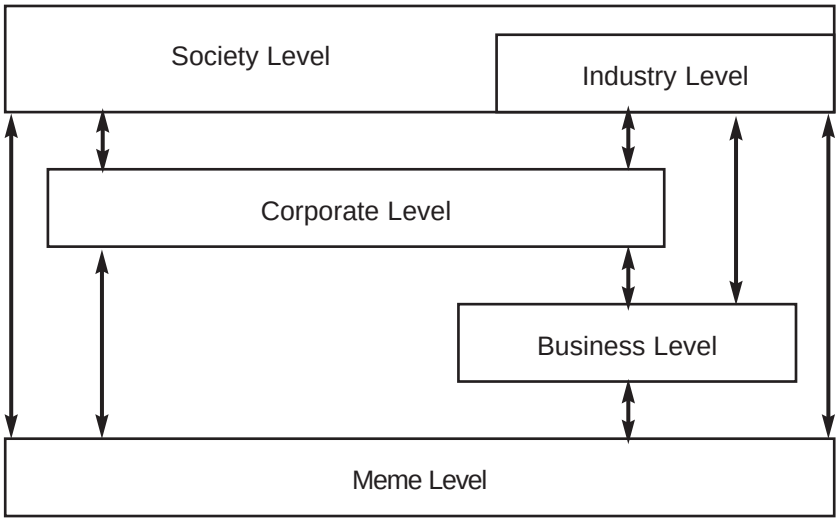

Figure 1. Basic interactions at the five levels of a firm's evolution

CORPORATE LEVEL STRATEGY FROM THE PERSPECTIVE OF FUNCTIONAL COMPLEXITY

Whereas hierarchical complexity focuses on structures, functional complexity is based on processes and therefore concentrates on change and modification. Within a strategic event, in our case a merger, existing orders are broken up by a disturbance cascading down the organization and leading to a chaotic situation. In the course of adaptive variation and selection processes, new and different patterns of order evolve and the newly merged firm may search again for its new position in the transition region at the edge of chaos. Modern biological evolutionary theory also sheds light on the processes of a firm's evolutionary changes, which occur on all levels of evolution (Dawkins, 1989; Greeno and Robinson, 1992; Eldredge, 1995; Wilson, 1998). A strategic change in a firm can be understood as one specific mode of variation and leads, on the one hand, to internal selection that is carried out by a firm's management and, on the other hand, to external selection through the economic and societal environment (Nelson and Winter, 1982; Baum and Singh, 1994; Fombrun, 1994; Levinthal, 1994; Miner, 1994). A merger process is, according to this perspective, either a sequence of emergent events, or something purposefully directed by the management (or a combination of both).

A merger thus should not be seen as an isolated strategic move, but as a sequence of events embedded in an evolutionary trajectory that are taking place at different levels over the course of time. In an evolutionary process such as this, driving and buffering forces influence the merger at different points in time. We have developed the point elsewhere in more detail that an evolutionary view of the merger process provides new insights into the emergence of functional complexity, but we summarize this development in the paragraphs below. An evolutionary approach provides a more systematic and comprehensi-

ve view of the merger process than is usually found in the literature and the cases discussed there (Blake and Mouton, 1985; Jemison and Sitkin, 1986; Schweiger and Ivancevich, 1987; Napier, 1989; Marks and Mirvis, 1992; Haspeslagh and Jemison, 1994; Shanley, 1994; Larsson and Finkelstein, 1999).

PATH DEPENDENCIES AND FIRMS IDENTITIES

At the beginning of a merger process, the two firms involved have different identities that are influenced by the individual path dependencies that result from their internal and external evolution. These identities are based on specific patterns of order. Complex adaptive systems such as merging firms are continuously evolving and the decision to merge catches the two firms involved "in flight", in the middle of their particular ongoing evolution. Because of these mechanisms, one has to take into account that the merger candidates' strategies originally were not aimed at a merger. Therefore, prior to the merger, they have gained a unique strategic position that is the result of their individual strategic trajectory, a trajectory that now drives or buffers the merger process.

These mechanisms also have an effect on a firm's structure. The merging firms' specific path dependencies, corporate governance systems and their basic organizational designs are usually different and normally have not been developed in the anticipation of a merger. The two future partners may differ strongly especially in the core structures providing stability and autonomy and in the fluid organizational elements providing flexibility and capacity for adaptation. Their position may differ substantially with respect to the edge of chaos.

The two merging firms' core values (culture) exert an effect on the merger mechanisms as well. They are driving or buffering forces that influence evolution in general and a merger in particular.

During the time before the merger itself takes place, the involved parties' needs and capacities for change may differ substantially. The merger candidates also have different degrees of autonomy to act with respect to their changing specific positions in the fitness landscape, a constellation that will be important for building the new firm's identity.

Path dependencies, ongoing changes in the firms' identity and the firms' specific positions in the fitness landscapes are the most important factors influencing the merger process and therefore in creating functional complexity.

THE MERGER PROCESS

At the very beginning of the merger process, disturbance cascades down the organization when the two merging firms' identities are combined. The formerly stable parts of their strategies, structures and cultures are destabilized, and the boundaries between order and chaos are drastically changed. In a merger, strategies have to be coordinated, structures have to be integrated and values have to be adapted. In an evolutionary perspective a merger creates a period of fundamental uncertainties with two major impacts. First, the merger opens up a new and wider range of variation in the patterns of order as com-

pared to the individual patterns that existed beforehand. The businesses of the previously independent firms can be connected in creative new ways, broadening the organization's field of activity and managerial discretion. Second, the increased need to select means that new selecting forces gain a different impact on the evolution of the newly created organization than they had before. New rules for internal selection processes, based on patterns of order, are important in ensuring managerial discretion.

Merging firms are in a situation of increased chaos. In the search for new patterns of order intended to reduce this chaos and in the attempt to move back towards the edge of chaos again, it can be observed —and this observation is confirmed in the literature we mentioned earlier—that the merged firm first, with great effort, creates a new legal and organizational structure that is intended to serve as a point of reference. At the beginning, this may lead to a structure that leaves open much room for subsequent self-organization. During this period of time, the high degree of uncertainty can also be absorbed by nominating key persons. The case material mentioned earlier, however, also shows that at the beginning of a merger, an elaborate strategy is mostly lacking. The merger is based on a few basic, often ambiguous, strategic ideas. The intent of the strategy and its trajectory are often clarified later by variation and selection in the coevolution of the two merging firms. As mentioned above, these mechanisms are based on core values. Both the relevant literature and our own observation demonstrate that merging firms very seldom pay attention to the differences between their core values. A general statement may be formulated, expressing their beliefs in a form favorable for the merger. However, this may be mere lipservice and not an expression of an actual new corporate culture. In an unclear situation like this, employees may use up their time and energy for years in the search for sense. Although the identities of the former firms are destroyed, the newly created firm's identity is not yet developed nor is it accepted by its employees or its other stakeholders. Seen in a positive light, this situation could represent a unique opportunity to strengthen the new firm's fitness if the firm purposely leverages the partners' interdependencies in values. However, this opportunity is mostly wasted. It is therefore not surprising that unsuccessful mergers are often explained by a lack of identity creation as well as by missing unifying core values in statements by managers as well as in the relevant literature. In an effort to compensate for the absence of a genuine identity and to reduce uncertainty, too much order may be established, which leads to less flexibility, and, consequently, to a firm missing the edge of chaos.

THE POST-MERGER PERIOD

Whereas the merger itself is a short burst of radical change, the evolutionary processes thereafter proceed at a slow, constant pace. The case material suggests that normally there are only minor structural variations and selections in the post-merger period. During this phase, more intense variation and selection processes are at work on a firm's strategy and even more intensely on its corporate culture. Depending

on its stakeholders' reactions and the remaining effects of the merger's variation and selection processes, a period of incremental change or even one of stasis may follow, although there may also be a need for relentless continuous change. The degree of uncertainty and chaos in each case is lower than in the merger period itself. As the empirical studies mentioned earlier and also practical examples demonstrate, it may easily take several years to reach the edge of chaos again.

From the perspective of functional complexity, mergers are viewed as a process in which individual evolution and the specific identities of separate firms are, after a period of relative stability, interrupted by a burst of radical changes, in the course of which strategies, structures and cultures are modified at a different pace than usual as a consequence momentarily creating a high level of uncertainty and chaos. The merger candidates' different fitness landscapes are connected on the basis of the new patterns of order. Initializing and guiding variation and selection processes on purpose may ensure the new firm's movement towards the edge of chaos and can even enlarge its evolutionary competence in reality. Traditional strategy theory hardly discusses these evolving processes. The principle of functional complexity therefore seems of particular value for future developments in strategy process research.

CORPORATE-LEVEL STRATEGY FROM THE PERSPECTIVE OF LAYER COMPLEXITY

Strategy theory normally views mergers as moves to create or defend sustainable competitive advantages in order to earn a strategic rent. Furthermore, a strategic rent is measured mostly in economic or financial terms such as cash flow, shareholder value, stock prices, etc. (Jensen, 1984; Davidson, 1985; Ravenscraft and Scherer, 1987; Trautwein, 1990; Katz, Simanek, and Townstend, 1997; Sirower, 1997).

However, modern biological and evolutionary thinking demonstrates that evolving systems are selected on the grounds of different categories of criteria involving different layers of judgment.

This priciple applies to internal selection that is purposely conducted by employees or managers who are defending their values and beliefs. These internal selection mechanisms and the accompanying criteria are complemented by external ones like markets and society.

Firms are thus always judged according to a complex system of evaluation, including different categories of stakeholders from different layers of a society. This is particularly true for a mega-merger, where a strategic move leads to the construction of a new firm with substantial economic and, possibly, political power. As we have demonstrated in Rühli and Sachs (1999), the Novartis merger made it clear that the firm's exposure to its stakeholder groups is highly intensified around events of such general interest. Although a certain decrease in a firm's exposure can be observed after a merger, the stakeholder interactions remain more intense, which shows us that a turnover pulse situation like a merger can change the intensity of stakeholder relations perma-

nently. Therefore, both stakeholder theory and management have to consider the fact that, in a post-merger phase, the selection pressure exerted by stakeholders has to be weighed more heavily, which will, in turn, have an effect on a firm's strategic, structural and cultural solutions.

Our frame of thinking therefore emphasizes societal as well as economic stakeholders, in the role of agents of judgements and selection. With their unstable interests, demands and strategies, they confront a firm with constantly changing, complex expectations that promote and represent a broad range of selection pressures firms have to consider. The most central source of a firm's external assessment of success and, consequently, selection, is represented by the laws of competition in the marketplace. External complexity can therefore be purposely created by one of the competitive arena's leading actors in order to gain a temporary competitive advantage.

Economic stakeholders, such as customers, suppliers, employees and shareholders, strive primarily for economic value, which is reflected by the tremendous impact that the announcement of a merger can have on stock prices.

In contrast, societal stakeholders confront merging firms with demands aimed at social and environmental sustainability with respect to a firm's activities and therefore, these stakeholders often refer to ethical norms and values. In contrast to other concepts of strategy, evolutionary thinking focuses more heavily on the societal context's significance in developing and selecting strategies in a coevolutionary process with the economic context. It therefore proposes an emphasis on the different layers of selection that are important in a firm's evolution and that the purely market-oriented view of strategy theory has so far neglected. Nowadays, societal awareness and fitness must be essential points of great managerial concern, especially in a merger situation, where this awareness can extend a firm's evolutionary competence. Firms thus are embedded in a network of stakeholders, who influences their evolution through their changing economic and societal expectations. Guiding coevolution through multiple stakeholder management thus ensures fitness and, consequently, strategic success.

Additionally, as mentioned above, modern biological evolutionary theory stresses habitat tracking as one way of acting within changing environments. This concept is particularly relevant for firms involved in a merger. If a firm's societal environment becomes disadvantageous enough, firms, at one time of the radical change, induced by a merger, may be reluctant to adapt, or, wishing to avoid being selected by a changing environment, they may move their activities into more favorable countries or regions. Habitat tracking, for example, can also be observed in the relevant case material when a firm is consolidating the merger candidates' analogous business units. The newly formed unit's location is often that in which the most favorable environmental conditions predominate. Current strategy theory has not developed this line of thinking very far to date.

Considering what has been said so far, it becomes evident that the principle of layer complexity sheds significant new light on processes

of strategic behavior in general and on the situation of a merger in particular.
Managerial discretion is thus enlarged by considering layer complexity. This implies a shift in managerial attention towards societal as well as economic conditions for success or failure that have so far been underestimated in traditional strategy theory.

FINAL REMARKS

Our reflections combining evolutionary and complexity theory are a further step towards a new strategy paradigm capable of dealing with complex realities. This is particularly true for a strategic move as complex as a merger. Our discussions suggest that these frames of thinking may be superior to other concepts in examining fundamental strategic changes in a firm. An evolutionary understanding of strategy demonstrates how managerial action shapes evolution for example at five interrelated levels in a merger situation. Strategic evolution is crucial to reaching the optimal position of fitness at the edge of chaos, which is imperative for strategic success within a complex competitive environment. We contribute to a non-linear understanding of firm behavior that must be explained through three types of complexity, namely hierarchical, functional and layer complexity.
Our contribution to the phenomenon of complexity is to distinguish among and elaborate on three perspectives based on modern evolutionary thinking.
First and most important, firms have to deal with the hierarchical complexity created through several interrelated levels of a strategic change.
Second, functional complexity is based on variation and selection processes that occurr at different, interrelated levels of strategic evolution. It is a dynamic way of considering the driving and buffering forces of evolution that may guide a firm towards the edge of chaos.
Third, these interrelated levels and evolutionary processes result in a firm's coevolution with its complex environment and emphasize the existence of different layers that have to be considered by the relevant stakeholders when evaluating a firm's strategic success. Strategic success is not reflected solely in an economic, but is also reflected in a societal dimension. At the corporate level, both dimensions can develop strong selection power.
Our contribution to a new paradigm of corporate strategy enhances the understanding of a complex adaptive system's internal structures and processes. This paradigm provides an aid to better understanding internal activities of variation and selection in strategic management. The metaphor of the firm floating at the edge of chaos highlights the aspect of a transit position between order and chaos vital to a firm in reaching high fitness that ensures strategic success. The consideration of the interrelatedness of a firm's different levels of strategic development and its coevolution with economic and societal layers contributes to a better understanding of a firm's strategic behavior in highly complex realities.

An evolutionary understanding of strategic changes such as mergers also provides new insights at the pragmatic level. Managers gain a richer understanding of the complex nature of a merger and the managerial discretion they have on the different but interrelated levels of strategic change. They also gain a frame of thinking for handling the complexity of strategic change at the corporate level with the goal of reaching a high level of success.

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