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From loosely coupled systems to collaborative business ecosystems

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Manuskripte
aus den
Instituten für Betriebswirtschaftslehre
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No. 573

From Loosely Coupled Systems
to Collaborative Business Ecosystems

Stephan E. Göthlich



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Abstract. Cooperations among firms as well as enterprise networks – albeit not a new phenomenon – gain attention both in science and practice since state of the art technologies such as internet and new information- and communication-media open new dimensions of its design. Network structures and concepts of collaboration are perceived as effective means to cope with the challenges of 21st century business life that is characterized as globalized and increasingly volatile, competitive and unstable. Numerous theoretical approaches to view interorganizational relationships exist. They range from the examination of pure market relationships via strategic alliances to complex and loosely coupled systems. Several economic theories such as institutional economics to name but one aspire to explain aspects of cooperations. These are generally focused on singular aspects only and therefore allow only restricted conclusions for strategy. In this article a holistic model for the understanding of business environments is derived from biological ecosystems. On this foundation three generic business strategies are outlined as well as hypotheses on the objectives that are likely to yield stability and sustainable success in the markets of the like described above. In this context the concept of resilience seems to play an important role. Finally first anecdotal evidence is provided where traditional theories fail to explain occurrences of today's business life but where the business ecosystem model indeed offers plausible insights.

Contents

1.	Introduction	1
2.	Views of business relationships and collaboration	2
2.1	<i>From market relationships to enterprise networks</i>	2
2.2	<i>Major theories on issues of cooperation</i>	7
3.	A biological metaphor: the business ecosystem.....	9
3.1	<i>Business ecosystem model vs. population ecology approach</i>	11
3.2	<i>Roles in business ecosystems</i>	13
3.3	<i>Strategies in business ecosystems</i>	15
3.4	<i>Success, stability and sustainability of business ecosystems</i>	17
3.5	<i>Drivers of resilience: hypotheses and agenda for further research</i>	18
4.	Anecdotal evidence of different actor-behavior in business ecosystems.....	24
5.	Concluding remarks	29
	References.....	32

1. Introduction

During the recent years a large number of publications on inter-company business relationships and collaboration have been published. Several different sciences engage in this research such as economics, sociology and psychology, technical sciences with a special emphasis on information, communication and computing as well as a broad range of literature from business administration. From all these sciences a lot of inspiring and insightful views on business relationships and theoretical approaches are contributed. Nevertheless they often focus on and highlight single aspects lacking the general context or – technically speaking – make *ceteris paribus*-assumptions. Other, more general approaches tend to be primarily descriptive and do not allow conclusions on normative suggestions for practical action. What is basically missing is an **integrating framework to which the existing views can be mapped** and that allows the derivation of concrete strategy options.

In this article a **model will be constructed** for such a framework by utilizing a metaphor from biology. The term business ecosystem will be used for this view, albeit it is not entirely new and willingly applied by practitioners. Nevertheless the view applied here will be differently specified in several aspects and covering a broader scope than conventional use. It is also made operational enough so that a transfer to practical application becomes feasible.

It will be proceeded as follows: In the beginning some views and **theoretical approaches** to business relationships, cooperation and networks are reviewed in very brief. After that the **view of business ecosystems** is developed and contrasted against evolutionary theories such as the population ecology approach. By having a closer look at basic concepts of ecosystem function in biology **central roles** species can adopt in biological ecosystems will be derived. These

roles are then transferred to business life, which leads to **three generic strategic options** for the players in business ecosystems. It is also asked for the **stability** of an ecosystem and hypotheses are drafted about which factors are likely to be a prerequisite for sustainable success in 21st century's business life. In the end **examples** of today's business phenomena are highlighted that are difficult to explain with traditional theories but become comprehensible from a business ecosystem perspective.

2. Views of business relationships and collaboration

2.1 From market relationships to enterprise networks

The very basic view on business relationships is usually considered by marketing people. They analyze spot **market relationships** between two end nodes, suppliers and customers. Even though this analysis is essential and sophisticated methods can be deployed it is a microscopic cutout from real life and a reduction on mere prices and quantities. Interdependencies of significant impact, especially long-run effects are often faded out. Computer support of these market relationships can be obtained with the implementation of customer relationship management solutions that provide knowledge databases, infrastructure and intelligence to acquire detailed customer profiles.

Strategic alliances are a superordinate concept that focuses on couplings between two firms that reach deeper than mere market exchanges do. These alliances can occur in one or more business functions, usually in horizontal relationships. Most mentioned are probably R&D partnerships. Notions such as cooperation and co-evolution are often linked with this concept. Literature concentrates on the questions of partner selection, linking and management of processes, the role of trust and the management of alliance portfolios (Badaracco, 1991, Bamford, Ernst, 2002).

A logical extension to strategic alliances are the entanglement of more than just two companies along a vertical sequence of value creation which is covered in the broad range of literature on **supply chain management** (for an overview see Corsten, 2001, Corsten, Gössinger, 2001, Werner, 2001). In these scenarios the operative parts of each firm's value chain are closely linked and synchronized along the whole chain. The aim is to streamline inter-company processes, to facilitate real-time planning procedures and to prevent buffers and slack. This generally requires sophisticated enterprise resource planning solutions with back-end-integration of systems. Moreover a holistic view of the chain has to be developed that disengages from individual and embraces collective optimizing. Models like e. g. the SCOR-model¹ support effective supply chain management.

Porter (1980) enhanced the view of the supply chain in his model of the five competitive forces. In addition to suppliers, customers and competitors both threats by substitutional products and potential new market entrants are monitored. The deducted lessons from this view on business forces have their origins primarily in the **theory of industrial organization** (IO). It dates back to the 1930ies and centers around the structure-conduct-performance paradigm (structure and conduct of firms are assumed to determine the outcome of an industry). From the 1970ies onwards IO was used to derive strategies for decision makers. These strategies encompassed methods of price discrimination and predatory pricing, vertical control, market entry or the deterrence of entry by building up barriers respectively, exclusionary tactics and market leadership. Strategies derived from IO tend to be rather uncooperative and if cooperation is regarded then it is often done in the form of collusion. As a consequence a large number of publications in (management) literature (see e. g. Hammer, Champy, 1992, Kotler, Bliemel, 1999, pp. 605 et seq.) appeared in print that resembled in many aspects and style modern versions of von Clausewitz' "On War", who

¹ SCOR-model = Supply-Chain Operations Reference-model; the SCOR-model was developed by the Supply-Chain Council in 1997; refer to www.supply-chain.org.

described strategies and elements of 19th century warfare. Nevertheless this broader view of the firm and its environment still focuses on the central firm itself and derives strategy-options rationally inside out. Interactions and interdependencies between all players were neglected to a large degree.

Already in 1976 Weick pointed out the missing hold on reality of this view, at the same time coining the term of “loose coupling” between actors. He hinted at the fact that organizations can simultaneously present rational and indeterminate elements, that both deliberate and spontaneous changes emerge and that a system can be open while at the same time closed (Orton, Weick, 1990, p. 204). Loose couplings are considered as sudden, occasional, negligible (!), indirect and occur eventually (Weick, 1982a, p. 380). In his so-called dialectical view Weick speaks of a **loosely coupled system** when a combination of both distinctiveness and responsiveness of its element exists. In doing so he firstly delimits it from tightly coupled, decoupled and noncoupled systems as shown in figure 1 (c. f. Orton, Weick, 1990, p. 205). Secondly he tries the splits between rationality on the one side and – hitherto isolated from this – indeterminacy on the other.

Distinctiveness	Yes	loosely coupled system	decoupled system
	No	tightly coupled system	non-coupled (no system at all)
		Yes	No
		Responsiveness	

Figure 1: Loosely Coupled Systems in Weick’s dialectical view

This makes the concept of loose coupling a welcome blueprint for the analysis of **enterprise networks**, where independent or distinct entities are orchestrated and by this responsive to each other. Nevertheless it cannot be denied that every

place where individual subjects interact and react to each other – in economics this is usually called a market – can be considered as a loosely coupled system leaving the whole concept rather fuzzy (as it is even conceded by Weick himself, c. f. Orton, Weick, 1990, p. 204). Thus fruitful comments on management and business strategy issues remained rare: Page-Jones (1980) highlights modularity in software development, Murphy and Hallinger (1984) addressed leadership questions demanding strong leadership in loosely coupled systems, whereas Weick (1982b) recommends school administrators to frequently leave their ivory tower in order to renew the glue amongst the organization's members and relight vision – an idea that strongly resembles Peter's and Austin's (1985) "managing by walking around".

In 1986 Miles and Snow introduced their view of enterprise networks as a flexible, fluctuating and dynamic structure that gained even larger attention and practical relevance after the management bestseller "The Virtual Corporation" by Davidow and Malone (1992). Today numerous network typologies can be found in the literature (for an overview see Sydow, 2001, p. 299, also Powell, 1990). Proposals range from strategic *hub-and-satellite networks* as in the automotive industry (Jarillo, 1988, Kerwood, 1995), *clan-like structures* as in Japanese Keiretsus (Ouchi, 1980) and *regional networks* up to *temporary networks* and *dynamic virtual organizations* albeit it is not even ensured that this collection of typologies is complete. Publications on this network topic have in common that they are predominantly *descriptive*. The models depict possible emerging outcomes of network structures, loose couplings and collaboration among companies. Anyway consolidated findings on efficient *management and controlling* procedures can hardly be deducted from these models. As an *example* consider a star-shaped hub-and-satellite-network compared to a polycentric architecture. One could guess that planning procedures have to be organized in a democratic way in the latter whereas in the former they can be more quickly enforced by the central hub. On the other hand this need not be the case if the satellite nodes retained enough bargaining power to defy the hub's orders whereas in the polycentric network the participants can decide to delegate this

task to the most competent partner.² Furthermore it *remains unclear* whether the described network types occur in pure exclusive form. One can easily imagine examples where polycentric networks are part of hub-and-service-networks or vice versa. Further questions discussed in this context are e. g. the coordination of tasks and processes within networks, the allocation of orders, the measurement of surplus or utility and the distribution of profits. The different relationships are summarized and depicted in table 1.

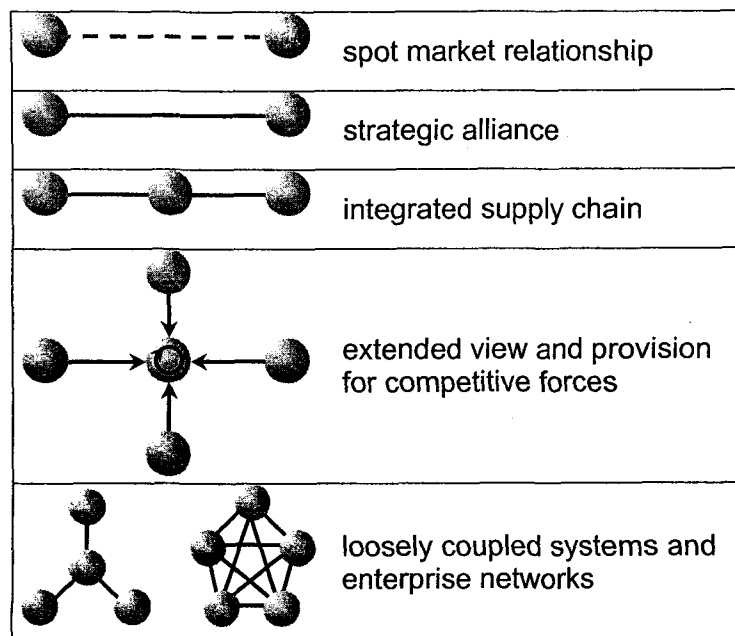


Table 1: Business relationships between firms

² Very similar ideas were already proposed by Simmel (1950), who considered a cooperation of two parties A and B. The interaction between these is facilitated via a third, bridging party C. C can take advantage of his position and play off A and B against each other thus gaining maximum power. However this need not be the case, when both A and B can observe his actions thereby constraining him to the rules imposed by them. However this need not be the case, when both A and B can observe his actions thereby constraining him to the rules imposed by them.

2.2 Major theories on issues of cooperation

Parallel to the research on enterprise networks there exist further branches that pick out different aspects of networks and the relationship among its actors as a central theme. **Economic theories** with major impact are transaction-cost- (Coase, 1937, Williamson, 1975, and the consequences), principal-agent- and property-rights-theory (for an overview see Hart, 1995). Very fundamental statements are that high uncertainty and a high asset specificity of investments as well as a low frequency of interactions will impede cooperation among firms and lead to integration of processes or even firms (and vice versa) because of an increasing threat of being held-up by the partners (opportunistic behavior). Information asymmetries may lead to adverse selection or moral hazard respectively if the moves of the cooperating partner cannot be monitored. Normative studies concentrate on the proper governance of collaboration under circumstances as named above. Even though these theories are highly sophisticated they cannot be adopted without criticism (Nooteboom, 2002), not least because of the failure to explain real life phenomena unambiguously (c. f. chapter four).³

³ In their bestselling textbook Picot et al. (2001) use mainly transaction cost economics (TCE) to explain why companies – subject to improving information- and communication technologies (ICT) that are said to reduce transaction costs – become more and more boundless and coordinated by market forces. They argue that under these conditions cooperative forms of (virtual) companies are favorable forms of organizations. Unexplained, though, remains the fact that the last decade has been a period of gigantic mergers and acquisitions that led to companies seldom experienced in scope before. Examples are Daimler-Benz and Chrysler (automotive), Vodafone and Mannesmann (telecommunication) or Allianz and Dresdner Bank (insurance / banking) to name but a few. Already Coase (1937, p. 397), TCE-mastermind, remarked that “Changes like the telephone and the telegraph which tend to reduce the cost of organizing spatially will tend to increase the size of the firm. All changes which improve managerial technique will tend to increase the size of the firm.” If modern ICT according to TCE can lead to both small market coordinated organizations and larger hierarchies then the question remains whether TCE is a suitable mean to predict the consequences of today’s information- and communication infrastructures.

A more recent arm are information and network economics (Katz, Shapiro, 1985, and the consequences, Shapiro, Varian, 1999; for a critical review on the network economy see Liebowitz, 2002) that highlight network externalities, the concept of lock-in in the presence of switching-costs (Klemperer, 1987) and questions of compatibility and standardization. The latter as well as indirect network effects are of special interest for organizational and managerial questions in enterprise networks. Indirect network effects arise, when another firm that is not tied by any means to the contemplated one produces a good or service that positively affects the success of the latter. Therefore the considered firm would be well advised to foster these effects.

Further theories to name in this context are game-theory (origins go back to von Neumann) and team-theory (Marschak, 1954, 1955) as well as inducement-contribution-theory (March, Simon, 1958); the latter originates from social and behavioral science.

Theories of social exchange view industries as systems of interconnected exchange relationships. They are aware of the fact that firms in a network are also indirectly influenced by others via third parties. Social exchange theory assumes relatively strong ties among the actors. In this context the importance of trust is often emphasized, a property that is usually neglected in economic theories that assume purely rational, calculating actors (*homo oeconomicus*). Since quick changes between alternatives are therefore difficult to realize they conclude that a certain inertia prevails and thus learning, history and path dependencies matter (for an overview see Easton, 1992, also Haakansson, Lundgren, 1997).

Building on this the **resource-dependency-approach** (Pfeffer, Salancik, 1978, Haakansson, Johanson, 1993) focuses on (inter-) dependencies between firms that come from the power to control scarce tangible and intangible resources. In this view uncertainty over the availability of essential resources can be reduced and dependencies weakened relative to spot market exchanges by forming long-term mutual partnerships that provide at least indirect resource-control. Therefore it is

in the interest of a firm that lacks essential resources to become open and transparent and willing to share own resources to become attractive to potential partners.

A derivative from sociology is the **actor-network-theory** (ANT) that tries to encompass also the *technical* aspects of networks (for a brief overview see Monteiro, 2000). Therefore actors in an actor-network can both be technical or human/non-technical. Actors influence each other mutually whereas the assumption is that there is no general dominance of human actors over technical ones. ANT builds on two basic concepts, *inscription* or programming, design or role allocation among actors on the one hand and *translation* that provides order and stability on the other. Furthermore as in social exchange theories inertia or irreversibility of once inscribed procedures is assumed that finally leads to conclusions that (especially complex computer supported) networks are likely to be hard to control. Basically ANT can be considered as a rather abstract description of basic business administration and the coordination concept of programming.

Finally there exist **evolutionary theories** that are discussed in more detail below while being delimited from the model developed here.

All of the theoretical approaches sketched above contribute single parts to the understanding of networks and collaboration. In the following chapter the attempt is undertaken to integrate these pieces in a single macro-perspective: the business ecosystem.

3. A biological metaphor: the business ecosystem

The use of the term business ecosystem is not a new discovery. To the author's knowledge it was first introduced by Zeleny et al. (1990) in their argumentation

in favor of a more human oriented, empowered working environment. The concept itself remained fuzzy. Three years later Moore (1993, 1996) used the term to describe a holistic view of a firm embedded in its relationships with its core business, i. e. suppliers, internal processes and distribution channels, its extended enterprise consisting among others of the indirect suppliers, suppliers of complementary products and customers, and finally the ecosystem in general encompassing stakeholders, economic factor providers, competitors, governmental institutions etc. If Moore's view is expanded virtually all issues enumerated in the preceding chapter can be pictured in this concept as is shown in figure 2. Subsequently Moore concentrated on defining evolutionary stages in the development of business ecosystems. He assumed a cyclical behavior beginning with birth, growth, maturity and finally death or renewal respectively. He then attributes strategies firms should adopt in the different stages.

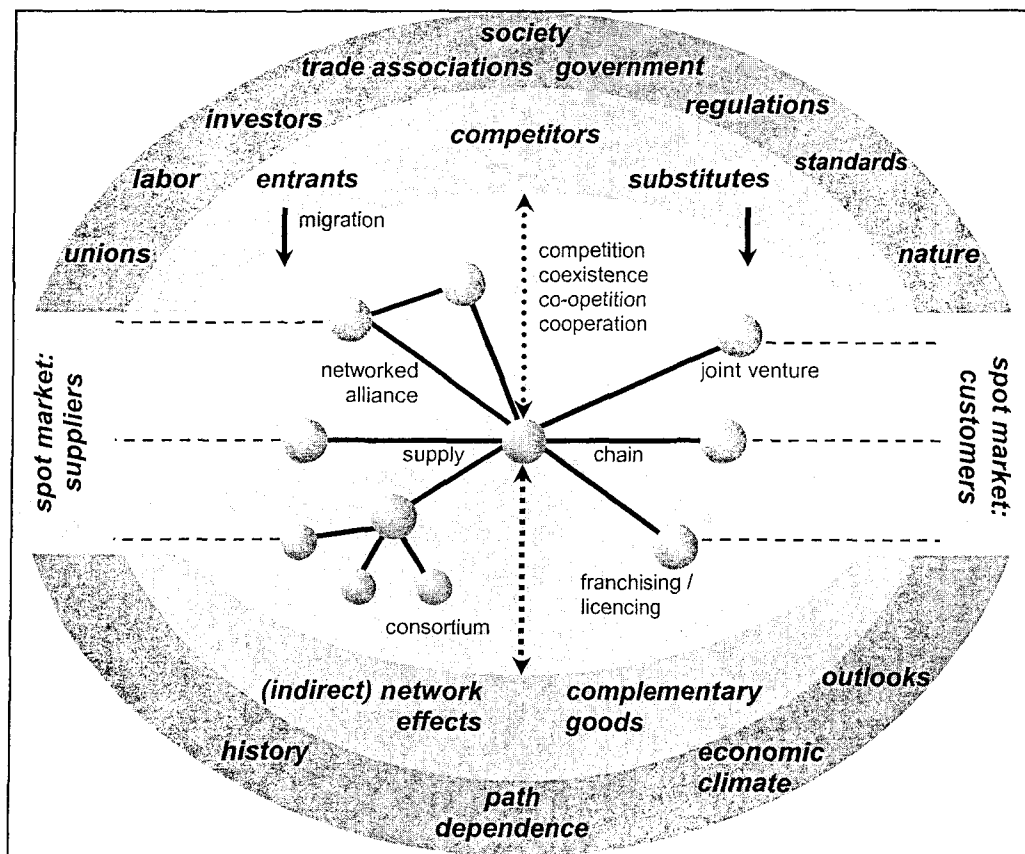


Figure 2: Business Ecosystem

3.1 Business ecosystem model vs. population ecology approach

Basically origins of Moore's mindset can be found in **evolutionary theories** such as the population ecology approach (Hannan, Freeman, 1977, McKelvey, Aldrich, 1983, and the consequences; for a short overview see Carroll, 1988). According to this organizations are subject to evolutionary processes similar to ecological ones where mechanisms like variation, selection, retention or reproduction are at work. Organizations are envisioned as collections of genes or comps (= competences) that can be varied or re-allocated in newborn organizations. Object of analysis are populations of such organizations. Their behavior is in essence determined by environmental factors and exogenous evolutionary processes. Organizations are said to be constrained by inertia that hampers rational decision-making and effective adaptation. This inertia originates from internal sources such as sunk costs, incomplete information of executives, political obstacles and resistances as well as the organization's history. External pressures arise e. g. from legal and fiscal barriers or legitimacy constraints (Hannan, Freeman, 1977, p. 931).

A considerable number of empirical studies using models adapted from biology were carried out succeeding and claim to support the population ecology approach (see overview in Kieser, Woywode, 1999). Nevertheless the approach couldn't elude severe criticism (e. g. Kieser, 1988, 2002, also van den Bergh, Gowdy, 2000, p. 43). According to this

- birth and elimination of organizations can hardly be seen as mechanisms of evolution. Even though they might frequently appear in some populations (as in the example of Californian restaurants, Hannan, Freeman, 1989, pp. 314 et seq.) they do not occur at all in others (Kieser (1988, pp. 610 et seq.) uses the example of the German automotive industry).
- the population ecology approach neglects the fact that the ability of organizations to react precisely and rationally (or at least more rational than

pure blind trials) to external shocks has indeed improved over time and therewith is itself subject to evolutionary processes.⁴ Thus organizational inertia can be influenced and retrenched. Learning processes as well as knowledge transfers in fact matter.

- no effective method has been defined yet how to separate populations from each other. Nevertheless the critics acknowledge that pragmatic approaches are viable and sensible so that the relevant population can be defined flexibly and depending on the research interest.
- the mechanisms of selection by the environment are not clarified.
- the population ecology approach does not provide normative statements for practical implementation. As a consequence recommendations for “evolutionary management” remain extremely vague or – as in Moore’s case – not operational at all: It shall not be denied that evolutionary cycles might exist during a firm’s lifetime. Nevertheless it seems to be an extremely tedious task for companies to define in which stage they currently are. It is well known that the ex ante definition of product lifecycles is error prone and even the prediction of economic cycles much too often imprecise. Defining evolutionary stages is likely to be foredoomed in advance.

Therefore this evolutionary perspective is abandoned for the moment. For the purposes of this paper a more static view is adopted that at the same time sticks closely to the biologists’ definition of ecosystems – therewith returning to what has been forgotten by population ecologists over time: the biological metaphor.

⁴ In a discussion on two articles of Ghiselin and Hirshleifer regarding economics and biology Coase (1978) remarked “that natural selection has an IQ of zero. The IQ of businessmen and politicians may not be high, but it is not zero. Natural selection produces its results by trial and error over long periods of time. Economic systems, such as the structure of an industry, may be transformed within a single generation.”

3.2 *Roles in business ecosystems*

According to biologists an ecosystem consists of the actors within a biological community or biocoenosis and its physical environment (Begon et al., 1996, p. 679). Since environment and biocoenosis are tightly intertwined a separate analysis is unreasonable. Ecologists aspire to analyze and understand the systemic coherences within the ecosystem. Of special interest is how ecosystems *react to external shocks* as for example the intrusion of new species or human interferences. The knowledge of these cohesions *support decision making* when protection or restoration of damaged ecosystems is intended. As a result biologists came up with three characteristic types of species behavior and roles in ecosystems depending (a) on the relative size or abundance of the species in the whole system and (b) on the particular strength of interaction of the species with the community members and therewith the impact the respective species has on productivity, diversity and sustainability of the entire system. They distinguish

- Dominator species
- Keystone species
- Niche species

Dominators strive to disperse over major parts of the ecosystem and occupy a maximum of nodes in the system's network and in doing so reducing species diversity. The term **keystone** is derived from architecture since a keystone is the top stone in an arch. A removal of the keystone will lead to a collapse of the entire building. Inversely rated to its size the keystone is of great importance to the arch or the ecosystem respectively. keystones leave enough space for other species to grow and to proliferate while at the same time controlling the system in a sense that they prevent other species from becoming dominant or repel the intrusion of dominants respectively. In doing so they reduce competitive stresses on the remaining niche players which leads to a higher diversity in keystone controlled ecosystems. Finally **niche** species are small both in size and impact.

The loss of a single niche species does not harm the ecosystem as a whole. The three roles are visualized in figure 3 (adapted from Power, Mills, 1995, p. 183).

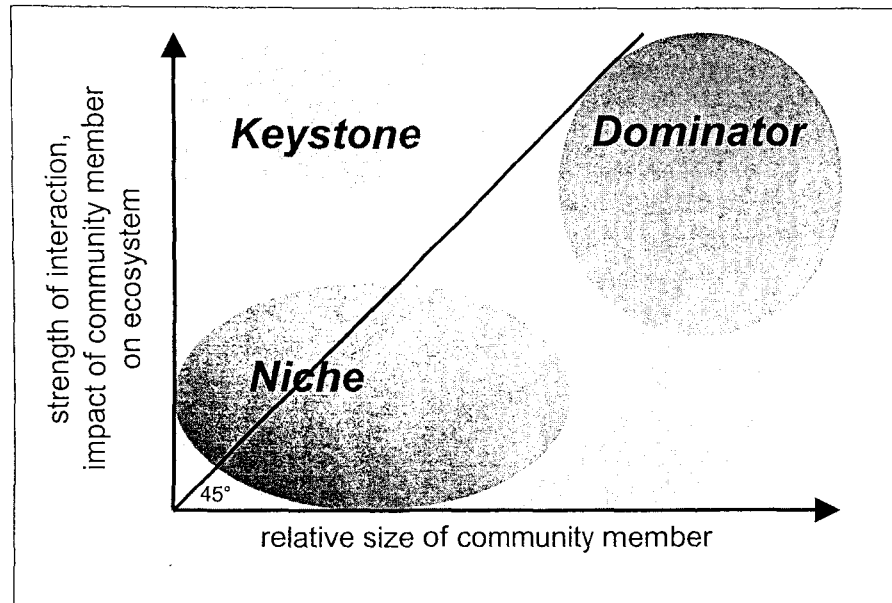


Figure 3: Roles and strategies in (business) ecosystems

Interestingly also in the population ecology approach the relevance of roles that organizations can adopt is emphasized (Hannan, Freeman, 1989, p. 95). Subsequently the approach confines itself to describe niches though. Likewise Porter (1980) stresses the niche and defines it as one of three basal business strategies a firm can adopt – besides the cost leadership and differentiation strategy. The derivation of these strategy options occurred more or less out of the blue (Porter, 1980, p. 35). Nevertheless they became fundamental guidelines for strategic decisions of firms during the 1980ies and 1990ies as well as a platform for innovations in science (e. g. think of cost management and management techniques such as kaizen, target costing or activity based costing).

The keystone concept was first introduced by Paine (1966), a biologist who carried out studies in aquatic ecosystems. In his experiments he artificially removed starfishes that preyed on mussels from a marine community. As a result the mussels proliferated heavily and aggressively covered the available living space thereby simultaneously repelling other species that originally populated the

habitat. Today several keystone modes of action have been identified in biology (Bond, 1993, p. 239), among them

- defeating of dominants and competitors, i. e. the protection of niche players
- mutualism, i. e. the direct support of niche players
- system enabling, i. e. enabling energy flows or the exchange between community members

As will be shown in chapter four similar behaviors of actors can indeed be observed in business. Therefore the analogy of biological and business ecosystems is appealing so that the roles in biological ecosystems will be directly transferred to business ecosystems in the following. Before this can be done one should firstly ask whether it is generally licit to adopt metaphors from biology for use in economics. Indeed biological analogies are often incorporated in economic literature and evolutionary theories which normally is considered as unobjectionable as long as not principles and laws of nature are directly transferred (Elkjaer, 2001). The latter is not done here.

3.3 Strategies in business ecosystems

Dominator strategies encompass largely the character traits postulated by industrial organization models. A dominator needs to learn and apply strategies of defeating competitors. It needs to pile financial means to buy other firms out of the market, needs to apply strategic pricing strategies and is constantly busy in erecting market barriers to deter entry. At the same time it needs to invest heavily into product and process innovations on its own since it cannot rely on creative partners other than the ones it acquired and integrated into its concern. Constant innovation is essential for otherwise it will loose its deterrence against other ecosystems. If a dominator is successful in building up and keeping its position it can extract high rents from its customers therefore gaining high profits at least in the short and medium run. It depends on in how far customers can be locked-in by the dominator so that its position can endure.

As already sketched above **keystone strategies** do not necessarily focus on proliferation. keystones observe markets and create platforms for products or services on which the niche players find fertile soil and develop either complementary applications and creating network effects or supply the keystone thus improving the overall value proposition for the customers. Keystones can contribute to streamline processes within the ecosystem by providing appropriate means of technology like standardized IT interfaces or back-end-integration to facilitate real-time planning. They need to monitor and control overall cost developments and initiate corrective action which demands skills in interorganizational cost management (c. f. Cooper, Yoshikawa, 1994, Cooper, Slagmulder, 2001). In addition it requires that they adopt a holistic view of the ecosystem and develop the knowledge how to handle the tasks named above. Keystones should strive for ecosystem wide efficiency by preventing the causes of market failures like for example negative externalities among community members or beggar-my-neighbor policies. They have to handle the task to balance the tradeoff between exerting pressure on partners to foster performance on the one side and to provide the necessary stability that keeps them from wasting too many resources in defensive measures of risk control. To the outside keystones act as guards defending the ecosystem against intruding dominators, which requires knowledge of dominator behavior. In doing so they ease competitive pressures for the niche players that can thus focus on their specific objectives.

Niche players' task in a keystone-controlled ecosystem will primarily be the fostering of innovation emanating from the platform the keystone created. Growing an expert in efficiently managing and controlling innovations (Hauschildt, 1997) will be a virtue as well as a challenge for niches. This requires that niche players also need to develop skills to adjust flexibly to the defaults originating from the ecosystem members or rather the keystone. This can for example be a matter of different software standards or process integration and demands a certain openness and transparency. To avoid inefficient extra work in the ecosystem niche players need to specialize on products and services that

belong to their core competence. In case of the absence of a keystone dominators might threaten niche players. As will be shown in chapter four a sensible self-protection strategy will be to collectively adopt keystone traits.

3.4 Success, stability and sustainability of business ecosystems

Answer has to be given now to the question which of the general strategies will be sustainable in a sense that it provides a relatively high stability and economic success in today's increasingly unstable market environments. Biologists distinguish between two basic concepts of stability (Begon et al., 1996, p. 838): The term **resistance** circumscribes the ability of a community to fend off external disturbances and invasions into the ecosystem. **Resilience** on the other hand describes the degree to which an ecosystem will return to its original position after an exogenous shock had occurred and the velocity of this adaptation. Even though research on the stability of biological ecosystems is not yet unambiguous in all respects a common denominator exists that in stable environments ecosystems can have a high degree of resistance but show a low elasticity, i. e. resilience, in case of shocks, which is among others due to low rates of reproduction or economically speaking: innovation.⁵ In volatile environments the ecosystem's communities primarily develop a high resilience and elasticity with high innovation rates (Begon et al., 1996, p. 847). Albeit in a slightly different context Moore (1996) uses the allegory of Hawaiian and Costa Rican ecosystems. The former were isolated by the pacific ocean and thus located in a stable environment until man induced intrusion inflicted great detriments on the ecosystem whereas the latter have been constantly under stress from both North and South America and evolved to be highly resilient to shocks.

⁵ NB: Population ecologists interpret the new foundation of organizations as reproduction and in doing so expose themselves to the criticism mentioned above. In this paper it is argued that innovations can also be perceived as a form of reproduction. It is not by incident that practitioners regularly speak of "re-inventing their business" when talking about innovations both in products, services and processes. In making this assumption – that innovations are the analogue for reproduction – the business ecosystem model gains a significantly higher operational impact.

It is therefore concluded that

- *if* the assumption is appropriate that markets tend to become more and more volatile and globalized and innovation cycles speed up – which can be considered as today's prevailing opinion – and
- *if* the ecosystem metaphor indeed holds for business environments
- *then* a dominator strategy becomes less likely a sustainable successful business strategy but on the contrary a fading fad and an increase in risk, since it reduces diversity and flexibility and is more likely to impede competition and innovation. In contrast to this a keystone-controlled ecosystem is more likely to develop resilience.

3.5 Drivers of resilience: hypotheses and agenda for further research

At this point of the analysis the following **propositions** can already be phrased:

- H1:** In order to derive normative statements on business strategy in complex and even collaborative environments the contemplation of micro-perspectives and theories alone cannot remain sufficient. A macro-foundation or –integration of micro-issues becomes essential.
- H2:** A macro-perspective is obtained by viewing businesses as ecosystems in which three major roles and therewith strategies – dominators, keystones and niches – can be distinguished and emerge simultaneously.
- H3:** Dominator strategies can be deducted from traditional economic models (especially IO).
- H4:** Contrary to traditional models further strategic options in the sense of keystone traits become sensible that encompass inter alia cooperations, coexistence, mutualism, refraining from proliferation, platform building, network creation, balancing the network and

facilitating of network-wide communication, collaboration and control.

- H5:** Stability is a prerequisite for sustainable business success.
- H6:** Two basic concepts of stability can be distinguished: resistance and resilience.
- H7:** The appropriate concept that is to apply depends on environmental conditions: Resistance is sufficient in stable environments. In unstable, volatile environments resilience is required.
- H8:** Dominator strategies are suitable to generate resistance but fail to produce resilience.
- H9:** Keystone-/niche-strategies are more likely to support resilience.
- H10:** Since market conditions of the beginning 21st century keep changing towards more volatile business environments firms should strengthen resilience.

Until this point the business ecosystem model just states that keystone-/niche-strategies are more likely to lead to a resilient ecosystem than dominator strategies do. This inevitably leads to the question what has to or can be done besides to obtain resilience or, more concrete, questions on

- governance among the cooperating firms and on
- (operational) control of processes and strategy in business ecosystems.

Governance is a subject of primary coordination (Friedl, 2003, pp. 9 et seq.) or the coordination of specialized firms and processes with respect to a superordinate objective. Issues of governance are analyzed e. g. in institutional economics and normative suggestions exist (for a concise overview see Nooteboom, 2002). The secondary coordination or the coordination of (inter-) dependent decisions in business ecosystems, tasks that are fulfilled by the controlling function, hitherto remains a white spot.

According to the hypotheses drawn up before **resilience** can be considered as the central objective both a community of coevolving firms as a whole and the individual firm itself is aiming at in order to create sustainable success in today's markets. The question now is whether there are concrete steps that firms can undertake in order to systematically achieve and control this objective. As pointed out earlier resilience describes the ability to quickly cope with changes and threats to return to a stable if not the former growth path. Unfortunately biological research does not deliver certain characteristic features that finally yield resilience. One could now succumb to population ecologists' argumentation of evolutionary management that resilience more or less evolves by trial and error processes and cannot be handled by rational control. This would mean to expose oneself to the criticism mentioned above. Therefore in the following the attempt is undertaken to derive hypothesis on drivers of resilience by deductive reflections.

Clues could be obtained from environmental economics where resilience is a topic within the framework of the debate on sustainable development of natural ecosystems (Perrings, 1998, van den Bergh, Gowdy, 2000). In this sense **diversity** "is a necessary condition for the resilience and evolutionary potential of both economic and environmental systems" (van den Bergh, Gowdy, 2000, p. 52). This consideration follows a precautionary principle with the underlying assumption that a maximum adaptability to unknown future conditions and events is obtained by a high variety of species within the ecosystem. These results actually support the hypothesis brought up above that keystone-/niche-strategies – that retain a higher diversity of species (here: species = firms) relatively to dominator strategies – are more likely to provide resilience.⁶ Nevertheless in economic modeling resilience is represented by a variable that indicates the

⁶ NB: Also Weick (1976) pointed out the necessity of a "requisite variety" proposing that "loosely coupled systems could more accurately register their environments through requisite variety" (Orton, Weick, 1990, p. 210). The concept of requisite variety dates from Ashby (1956).

probability of a collapse of an ecosystem and transition to another state, which contains no information in the determinants of resilience itself.

Since this is unsatisfactory from a business point of view one is left on its own in specifying drivers of resilience. To start from scratch it appears logical for firms within a business ecosystem to be able (a) to sense and (b) to respond to dynamic, unpredictable changes in demand, supply, pricing, labor, competitor's moves, capital markets, the needs of its customers, suppliers and partners etc. If exogenous shocks are not even registered all further considerations with respect to resilience will turn out to be superfluous. Furthermore it seems sensible to postulate that the detection of changes as well as the evaluation of its impact should occur in early stages. At the same time communication within the business ecosystem is required to pass off at high speed and a joint cognition should prevail to support this. What is basically needed can be subsumed under the term **responsiveness**.

A necessary prerequisite to be implemented to achieve responsiveness is scalability or **variability**. A firm that bears the burden of high sunk-costs and fixed assets and processes has indeed predefined its future history and fate for the years to come. To obtain variability a firm must engage in increasing the proportion of variable cost structures and adapt process flexibility while at the same time operating at high levels of productivity and (capital) efficiency, cost control and financial predictability. As already mentioned in the discussion of loosely coupled systems modularity as a feature can also contribute to variability. Modularity applies to products and services and facilitates outsourcing strategies but it is also conceivable to design even internal processes in a modular manner so that an outtasking is made feasible.

Notwithstanding it is as a rule not feasible to run a business on variable costs only. It is inescapable that investments have to be made. Therefore it is rational to allocate resources to its highest productivity – meaning for a firm that it invests in assets it can handle best. This is nothing else than the core competence idea and is

in fact what companies dealt with during the last decade triggered by the findings of Hamel and Prahalad (1990, 1994). Hence the approach presented here is not in contradiction to prevailing doctrines but on the contrary seamlessly integrates and is the logical sequel to present business evolution. Subsequently the **focus** on core competences while at the same time coupling themselves with strategic partners in collaborative business networks can be regarded as a first step to a resilient business ecosystem.

Propositions:

- H11:** Contrary to other theories referring to biological metaphors active management of business ecosystems need not be blind or on a trial and error base. Governance and controlling in collaborative business ecosystems are feasible.
- H12:** Logical deduction yields at least four drivers of resilience – diversity and inter-organizational cooperation, responsiveness, variability, concentration on core competences – that can be deliberately designed and controlled by firms in a business ecosystem.

Consequently **further research** needs to start here:

- If the business ecosystem model holds then firms should be expected to undertake measures to deliberately achieve objectives as enumerated above. Do they? If so, which ones?
- Do they implement measures that do not fit the traits mentioned above but can be considered to foster resilience though?
- Can firm's behavior be explained with the business ecosystem model? Especially: If markets do become more volatile the business ecosystem model implies transitions from dominator- to keystone-strategies. Can such be observed? Which flaws remain?
- It is unquestioned that technology often is driver of new developments and organizational structures. Which means and tools are deployed? Especially: In how far can and do state of the art technologies of information and

communication as well as electronic business support information flows and coordination in business ecosystems? Are they implemented with the intention to support a business ecosystem?

- Where are the boundaries of these technologies? Which old problems of coordination do they solve and which new problems do arise when they are implemented? Can the latter be avoided and how?
- What are the consequences for business strategy? Especially: Do there arise specific problems for niche-, keystone- and dominator-firms respectively that have to be solved in separate ways?
- In how far can this hitherto static model be amended by dynamic aspects? Are roles in business ecosystems defined just by the relative size of a community member in status quo or also by the objectives a firm pursues with respect to impact and size?

Indeed the technology aspect offers access to the study of these questions. Until this stage the model presented here is derived from literature analysis that is contrasted against real life phenomena obtained from qualitative data analysis of newspapers and documents as well as discussion analysis with IT-practitioners and biologists. What is basically needed is in-depth and explorative case study research in firms that actually operate in markets of the like described in the beginning – which are likely to be major companies especially from high tech sectors. These case study research needs to combine aspects of theory testing with regard to the business ecosystem model as well as aspects of theory building since a lot of questions remain unanswered, yet, e. g. dynamic aspects of and processes in business ecosystems (on case study research c. f. Eisenhardt, 1989, Haag, 1994, also Glaser, Strauss, 1967, Strauss, Corbin, 1998, Stake, 1995, Yin, 2002).

4. Anecdotal evidence of different actor-behavior in business ecosystems

Since in-depth empirical findings on business ecosystems cannot be delivered in these early stages, yet, at least some recent anecdotal evidence shall be provided to illustrate different ecosystem behaviors in real business life. The selection of the cases presented here – except from the first one – are derived from newspaper data analysis. The examples expose loopholes of the theories and approaches mentioned in chapter two that can be mended by applying the business ecosystem model.

An interesting case is **EHG Elektroholding GmbH**, Frankfurt/M., Germany, that virtually is the remainder of the former electrics and electronics giant AEG. AEG – having in best times almost 180.000 employees – was dissolved in 1996 after several years in constant decline. The mission of the approximately 30 employees that are left today is to license the brand name and logo of AEG. The former global player was virtually the inventor of what is today known as corporate identity and its brand name recognition is still outstanding. The EHG provides a large number of mostly small or rather medium sized companies with a brand name serving as platform and stepping stone to successfully enter markets and persist (*keystone* trait of platform provision). EHG can be considered as a strong interactor in the center of its network that now provides a product range from premium lighting applications, power controls, IT, telecommunications and electronics, power tools, domestic and medical appliances to consumer electronics on a global scale. In addition EHG is extremely small in relation to its ecosystem (c. f. figure 3, where it is likely to be placed in the borderland between keystones and niches) and its extinction would inflict severe economic harms upon the licensees if not a loss of autonomy and integration into other major, i. e. dominant players. EHG protects the network by carefully monitoring the use of

the brand name and logo to ensure the high quality image that benefits the entire ecosystem.

A second example can be found in the German retail-market that is known for being highly competitive. When **Wal Mart**, an U.S. based retailer and *dominator* “blamed for the destruction of entire communities” (The Economist, 2001), entered the German market with predatory pricing strategies (Handelsblatt, 2000) the incumbents – at its top the retail chain **Aldi** – managed to assimilate the intruder keeping him on small market shares. Due also to several other mistakes Wal Mart’s engagement in Germany became one of the greatest throwbacks in its history. According to its own explanations Aldi nurtures its suppliers by granting high-volume, long-term contracts. In this way Aldi eases competitive stresses and uncertainty for its suppliers, which gain a basis for strategic planning and investment at lower risk and in turn provide Aldi with extremely cheap products at a very high quality (*keystone* traits of mutualism). Nevertheless Aldi is known for rigorous outlisting of suppliers that do not match quality- and turnover-standards therewith keeping its supplier base under healthy market pressure. Interestingly Aldi, its products and logistical abilities are perceived as one of the most innovative among German companies (Wirtschaftswoche, 2000). At the same time Aldi does not strive to proliferate into all segments of the entire retail market (*keystone* trait of non-proliferation). It strictly sticks to a product range of just about 500 items and sells no-name commodities only. In doing so it leaves space for other retailers that offer branded products.

Whereas the defeat of Wal Mart’s market entry presumably can be explained with standard models of industrial organization this is unlikely the case when the behavior of **Porsche**, a sports car maker, is observed. In the end of 2002 when economic outlooks grew increasingly gloomy across Europe more and more automotive suppliers were threatened by insolvency. Porsche hit the headlines by announcing that it will send financial means and F&A personnel to avert doom from its partners (Handelsblatt, 2002) – a behavior that can be explained with the *keystone* role as described above. When Porsche began to build its new

production plant in Leipzig in 1999 it rejected – contrary to its competitor **BMW** – generous state subsidies that the car makers were entitled to receive. Thus Porsche indirectly benefits society and the state as part of its ecosystem. Even though Porsche is focused on a small product range of just three models it currently became the most profitable carmaker in the world.

In addition there are further topical occurrences that cannot offhandedly be explained with standard models from e. g. institutional economics. The German banking system is currently captured in a severe earnings crisis. **Deutsche Bank**, Germany's largest private sector bank, tries to tackle costs by completely outsourcing one of its most critical backbones to International Business Machines Corporation, **IBM**: its IT. According to transaction cost economics an outsourcing of this highly specific asset is unlikely. The same holds for **Visteon**, a major automotive supplier, that ties itself to IBM in the same manner and over a contract period of ten years while simultaneously exposing itself to the danger of opportunistic behavior by IBM. Visteon is said to undertake this step to become more independent of Ford, its major customer and partly also provider of its IT-infrastructure (Handelsblatt, 2003a). Nevertheless these examples give rise to the question whether the traditional theories and approaches are still suitable to unambiguously explain current business life. From the perspective of the business ecosystem model these behavior patterns become understandable: Adopting *keystone* traits becomes a sensible reaction to changing environmental conditions.

A relatively stable ecosystem are the consumer-goods markets since at least demand uses to be stable and shocks are unlikely. The business ecosystem model leads to the conclusion that *dominators* are likely to prevail – which is indeed the case when one regards companies such as **Unilever** and **Procter & Gamble** (P&G). These two have a stronghold on most markets around the globe and own hundreds of brands with major impact of which quite a lot were bought out of the market by acquisition of niche players. P&G's buy of Wella, a haircare and beauty company supplying European and Asian markets, in March 2003 therefore was no surprise. Two questions impose themselves: What impact will the strategy

of the dominators have on the remaining ecosystem members? And of more importance: What does the ecosystem model teach niche players that encounter a dominator in the absence of an obvious keystone? To cover the first question a closer look is taken at four Europe based (non-food) consumer-goods companies that are *niches* relatively to Procter & Gamble and Unilever (see table 2): **L'Oréal**, current worldwide market leader in haircare and beauty, **Henkel**, a producer of detergents, cosmetics, bodycare and adhesives, **Wella** (see above) and **Beiersdorf**, a company that focuses on bodycare, dressing materials and adhesive tapes. (Colgate will not be considered in the following and serves just as comparison.) P&G's brand range covers the products of all four firms listed here. First of all an integrated Wella, swallowed by P&G, now poses a severe threat to the position of L'Oréal. Since P&G is at least three times as big as L'Oréal it possesses means to cross-subsidize its haircare and/or beauty business, entangle L'Oréal in skirmishes and breaching its profit margins. Henkel lost a chance to promote its own underdeveloped haircare and cosmetics business and now faces an even stronger P&G in its remaining product branches since Wella, as a well run and profitable firm, will contribute to the power of P&G. At first sight, Beiersdorf can feel relieved since P&G also intended to takeover the company but in the current situation is lacking the financial means to do so. Nevertheless it is just a matter of time until the war-chest of P&G is filled again – not to forget that Unilever is likely to lurk. The situation for Wella and its employees is unclear, yet, albeit larger layoffs are not expected. What is indeed clear is that Wella lost its sovereignty and is not unlikely to become a cash-cow for P&G. As a result all niche players enumerated here basically are worse off at least in the medium or long run.

<i>data per 2001</i>	Sales (million €)	Assets (million €)	EBIT (million €)	Staff (thousands)	Number of (major) brands
P&G	<i>total</i>	43,604	38,208	6,011	86 considered as key brands, total: about 300
	<i>ex food</i>	39,179	35,453	4,522 (before tax, EBT)	
Unilever	<i>total</i>	52,206	52,766	5,258	42
	<i>ex food</i>	22,777	n/a	2,826	22
L'Oréal	13,740	14,872	1,669	50'	16
Henkel	9,410	9,365	0,602	47'	45
Beiersdorf	4,542	3,247	0,466	18'	11
Wella	3,187	2,435	0,274	17'	19
Colgate	10,474	7,761	2,038	n/a	13 considered as key brands

(US-\$ values converted to € at an exchange rate of 1 € = 0.9 US-\$ (as of Dec 2001).)

Table 2: Key figures of selected consumer-goods companies

Source: company reports, own calculations.

What would have been the lesson learned for the niche players from the business ecosystem model since no obvious keystone firm is present in this ecosystem? The answer is: Adopt keystone traits of mutualism. This could e. g. happen in mutual financial stakes to prevent dominators from gaining decisive influence over a single company. This is indeed what Henkel tried in the last minute by buying a seven percent stake in Wella but left on its own devices its means were insufficient.⁷ One could object that this would lead to governance-problems. Nevertheless if this were the case one could recur to e. g. transaction cost economics that offer a broad range of guidelines how these problems can be tackled (see e. g. Nooteboom, 2002). Besides this other forms of close cooperation among niches are feasible that make them less attractive to a dominator-takeover (on the Wella-takeover by P&G see Handelsblatt, 2003b, Wirtschaftswoche, 2003, The Economist, 2003).

These considerations give rise to a further **proposition**:

H13: Niche players threatened by dominator behavior and bare of a keystone protector should be able to adopt single keystone traits such as e. g. mutualism to protect themselves.

⁷ What made matters worse was that Wella was owned to a large degree by an estranged family.

This proposition can even be extended if one thinks of cooperatives (or in more fashionable newspeak: virtual corporations) that emerged especially during the second half of the 19th century as a reaction against the giant emerging joint-stock companies (for a brief history, purposes, significance of cooperatives in Germany, legal aspects and governance, and the theory of the cooperative see Stumpf, 1998, Kübler, 1998, pp. 140-151, Eisenhardt, 2002, pp. 443-449, Boettcher, 1974). To give an example, significant parts of the German banking system are organized as local cooperatives (**Volks-** and **Raiffeisenbanken**) that ally themselves under the roof of **DZ Bank**, Frankfurt/M., that provides the local banks with functions and properties (e. g. research, nationwide availability of services) otherwise only the major private sector banks could offer. The same holds e. g. for the **EDEKA**-cooperatives in retailing.

Proposition:

H14: Contrary to biological ecosystems niche players in business ecosystems are generally in the position to even give birth to keystones to stabilize their ecosystem.

5. Concluding remarks

As can be observed in the single examples above old dominator traits are more and more left behind in today's industries and business environments that often show patterns that don't appear logical within the framework of conventional models. At the same time firms make the impression to seize increasingly the characteristics of keystone-/niche-strategy behavior. In figure 3 this could be depicted in form of a move from the top right corner to the left. This raises hope for the feasibility that old dominators hitherto sticking to Porter-esque doctrines will manage a transformation.

With the model of collaborative business ecosystems presented here a first step is undertaken to deliver explanations for phenomena in current market developments and behavior of firms. The business ecosystem model integrates several theoretical approaches into a macro-perspective, which can be regarded as an eclectic paradigm. But it is indeed more than just the sum of its parts since it offers new insights that remained hitherto uncovered by traditional views.

Nevertheless the model remains not flawless. In biology the identification of keystones is generally intricate and not undisputable. In fact in the economy it will be even more complicated. To measure the relative size of a company in a specific industry is simple even though various measures can be used such as working capital, market capitalization, number of employees, market shares or revenues/sales/turnover. The impact of the firm for the whole ecosystem on the other side is hard to estimate since an experimental remove of firms from the business ecosystem is not an option. Measures such as density or connectivity, i. e. the ratio of realized to potential couplings and interactions a firm installs, or centrality, i. e. the degree of integration or isolation within the ecosystem, could be used as a proxy. Additionally, since the model builds on the assumption that stability and volatility of the environment matter for strategy selection, appropriate measures have to be defined that allow to determine different degrees of environmental change.

This in turn raises further questions: How can a relevant ecosystem be marked off? Or can one company be actor in several ecosystems at the same time and in different roles? These questions are indeed tricky and even biologists did not succeed in providing guidelines for the separation of ecosystems, yet. (Note that these are the same aspects population ecologists had to deal with.) Nevertheless one has to ask whether these questions are critical for the general usability of the business ecosystem model. Without fail the model offers decision makers in firms concrete strategies that simply depend on the point of view the manager takes up. Upward looking he or she could be part of a superordinate system and serve as a niche player while at the same time he or she is a keystone for its downstream

partners and recommended to take over keystone tasks. In addition these strategies can systematically incorporate the knowledge that different scientific disciplines engaging in the analysis of enterprise networks and collaboration among companies generate. Thus the model is not in contradiction to prevailing doctrines. If one takes into account that markets become increasingly volatile the lesson from ecology is that keystone-/niche-strategies striving for a maximum degree of resilience will become most likely to be sustainable. A very pleasant property of the model – that differentiates it from traditional approaches – is that it allows for different strategies to prevail in an ecosystem simultaneously, which makes an explanation of real life's manifold characteristics of business possible.

It should be added that it is also conceivable that the business ecosystem model can be applied in other fields of economic research. One could think of competition and antitrust policy (considerations aiming in this direction are contained in Iansiti, Levien, 2002), regional economics and governmental policy (the state as a keystone for the national business ecosystem), or political science.

Nevertheless further research is necessary. Empirical data on dominator or keystone behavior would be helpful and a clarification of the way how to demarcate an ecosystem desirable. The means and manner to obtain and enhance resilience are of special interest. Furthermore an analysis of specific problems of coordination within business ecosystems and the generation of appropriate solutions will be of importance.

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