

STRATEGIES FOR MANAGING A PORTFOLIO OF ALLIANCES

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Interorganizational relationships are recognized as an increasingly important source of competitive advantage. Hence, goal-oriented management of the alliance portfolio—all the alliances of the focal firm—plays a decisive role in company performance. Consequently, the configuration and development of the alliance portfolio become important strategic issues. In light of that, this article develops theoretical propositions that seek to clarify what determines the configuration and evolution of an alliance portfolio, and then presents the results of a longitudinal study to illustrate the developed theoretical framework. Building on contingency theory and a coevolutionary framework, we were able to identify three distinctive types of portfolio strategies at business level and to illustrate how they interact with the development of the business strategy and the business environment. Encompassing all this, the study illustrates and explains developmental paths and patterns in the evolution of an alliance portfolio. The developmental course typically evolves from adapting to shaping and to exploiting (stabilizing), according to the state of strategic uncertainty and the firm's resource endowment. A sudden increase in exogenous strategic uncertainty, however, can lead to a strategic shift back to an exploration or hybrid strategy. Copyright © 2007 John Wiley & Sons, Ltd.

RESEARCH QUESTION AND OBJECTIVES

The importance of alliances and networks has increased greatly during the last decade (Hagedoorn and Osborn, 1997; Harbison and Pekar, 1998). Leading companies, particularly in such dynamic industries as biotechnology, computers, and telecommunications, have increasingly used different kinds of cooperative interorganizational relationships (e.g., contractual alliances, consortia, joint ventures)¹ to improve their resource endowment and to master strategic uncertainty better than

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¹ In the following we use ‘alliances’ as the generic term for all types of cooperative interorganizational relationships that want

their competitors (Eisenhardt and Schoonhoven, 1996; Hoffmann and Schaper-Rinkel, 2001; Powell, 1998). As a result, many firms today are embedded in a dense network of interorganizational relationships with customers, suppliers, competitors, and complementors (Brandenburger and Nalebuff, 1996; Gomes-Casseres, 1996). How the focal company is positioned in these intertwined relationships significantly influences its competitiveness (Dyer and Singh, 1998; Gulati, 1998, 1999). Interorganizational relationships are therefore recognized as an increasingly important source of competitive advantage and superior performance (‘relational view’; Dyer and Singh, 1998; Gulati, Nohria, and Zaheer, 2000). Consequently, the configuration of the whole alliance network and guidance of its evolution become important strategic issues for firms engaged in numerous alliances.

to create and/or protect competitive advantage (Doz and Hamel, 1998; Hagedoorn and Osborn, 1997).

Interestingly, most previous alliance research concentrates on the management problems associated with, or within, a dyadic relationship, neglecting consequences from the circumstance that dyads often are embedded in an interorganizational network that encompasses many different interorganizational relationships (Das and Teng, 2002; Kenis and Knoke, 2002). Only recently have authors emphasized that there can be strategically important interdependencies among a firm's individual dyads and alliances (Gomes-Casseres, 1996; Gulati, 1998: 308). Authors that deal with problems associated with managing multiple dyads address their object of inquiry using terms like multilateral alliance (Doz and Hamel, 1998), alliance constellation (Gomes-Casseres, 1996), alliance network (Das and Teng, 2002), and alliance portfolio (Powell, Koput, and Smith-Doerr, 1996). The concepts of alliance constellation and multilateral alliance are usually used synonymously and designate alliances with more than two partners (multi-partner alliances). Alliance networks, on the other hand, are collections of several alliances linked by individual 'actors.' Considering an alliance network from the perspective of a focal company—i.e., focusing on all alliances that the observed company has—is known as an alliance portfolio (egocentric alliance network). Since we wish to concentrate on the strategic management of a focal company's multiple alliances, we will use the term alliance portfolio.

To implement corporate and business strategies successfully, firms often cannot rely on single high-profile alliances. They need a comprehensive alliance portfolio strategy that provides access to required external resources, using several coordinated alliances (Gomes-Casseres, 1996: 212). What really matters is not the success or failure of a single alliance but that the company will reach its strategic goals with the bundle of its alliances, thus placing the structure and strategic orientation of the whole alliance portfolio at the center of interest.

A qualitative study of the alliance management practices of 25 large European companies (Hoffmann, 2005) revealed that multi-business firms pursue alliance-related strategies that are an integrative part of the business strategies and are mainly formulated and implemented at the business level—even though most of the investigated firms also implemented an overall alliance policy at the corporate level, defining the basic principles

and rules of forging and managing alliances.² This means that alliance portfolio strategies³ are mainly defined at business level, to set the overall strategic goals of all alliances in this business and to determine the structure of the business-related alliance portfolio.

In light of that, this research seeks to clarify what determines the configuration and evolution of the alliance portfolio of a business unit and what kind of relevant strategies a firm can implement at business level to guide the development of the alliance portfolio. Specifically, this article attempts: (1) to develop a strategy typology for alliance portfolios; (2) to determine how the selected strategy affects the way the alliance portfolio is configured; (3) to identify the contingency factors influencing the choice of portfolio strategy; and (4) to show the effects of portfolio strategy on the resource endowment and performance of the focal business unit. Above all, it is our objective to describe and explain the connections among business environment, portfolio strategy, and configuration, as well as the resource endowment and performance of the focal business unit *over time*.

This paper enlarges the scope of alliance-related research to include issues that arise from managing multiple alliances. It contributes to the field by identifying developmental patterns and paths of alliance portfolios as well as contingency factors that influence these developmental dynamics and their performance consequences.

THEORETICAL UNDERPINNINGS

Alliances connect some resources and activities of cooperating firms, thereby linking their development. Thus company and environmental development are loosely coupled by all of the focal firm's alliances and influence one another, leading to a coevolution of the focal firm, its alliance portfolio, and its environment (Koza and Lewin, 1998).

² According to Hoffmann (2005), the alliance policy at corporate level includes (a) general principles of managing and overseeing alliances, (b) general requirements for a partner, (c) rules on areas (businesses, value steps) and situations in which to cooperate (or not to), (d) rules on how to cooperate (configuration of alliances) and (e) establishing a 'dedicated alliance function' (Kale, Dyer, and Singh, 2002) and creating an infrastructure for managing the alliance portfolio successfully.

³ We use the terms 'alliance portfolio strategy,' 'alliance strategy' (Gomes-Casseres, 1996), and 'portfolio strategy' synonymously.

Every alliance of the focal firm's alliance portfolio is simultaneously embedded in the interorganizational field (Kenis and Knoke, 2002). By selectively modifying its alliance portfolio, the focal company can influence the interorganizational field in which it is embedded. Likewise, changes in the interorganizational field affect the alliance portfolio and company development. Alliances can be viewed as a firm's adaptive behavior to maintain a match between firm strategy and resource endowment on the one hand and changing environmental conditions on the other.

Considering the role of alliance portfolios in enabling a dynamic fit between the internal resource endowment of a firm and the external requirements it faces, we build our research on a contingency-based approach of strategic choice and on a coevolutionary model of organizational adaptation. *Contingency theory* (Drazin and Van de Ven, 1985; Miller, 1981) assumes that an organization's structure and strategy must fit its context (especially the conditions of its environment) if it is to survive or be effective. This means that the structure of a firm's alliance portfolio must be aligned with external environmental conditions, internal resource endowment, and firm strategy to positively contribute to firm performance. Typically, contingency theory is static—i.e., it does not describe and explain processes that maintain a fit between structure (strategy) and context over time.

The *coevolutionary perspective* (Koza and Lewin, 1998) emphasizes developmental processes and assumes that there is not a unidirectional influence between environmental and organizational characteristics but that these parameters influence one another by mutual adaptation. Accordingly, a coevolutionary model allows describing and explaining how firm development and environmental development are linked by the alliance portfolio of the focal firm and how developmental processes at firm level, alliance portfolio level, and environmental level influence one another over time. The (co)evolutionary approach highlights the importance of a fit between organizational characteristics and external selection criteria for firm survival (Baum and Singh, 1994; Nelson and Winter, 1982). It also allows consideration of intentional variation and managerial selection (Aldrich, 1999). Thus the basic premises of the coevolutionary approach and contingency theory of strategic choice are compatible (e.g., see Park, Chen, and Gallagher, 2002),

and both these theories are quite appropriate as a common basis for our research.⁴

From the *resource-based view* of strategic management (Barney, 1991; Peteraf, 1993; Wernerfelt, 1984), alliances and interorganizational networks are used to link complementary resources so that the firms can utilize synergies by pooling or transferring such resources (Ahuja, 2000a; Eisenhardt and Schoonhoven, 1996).⁵ The resource endowment of the focal company not only determines its performance but it also has a fundamental influence on its alliance strategy and its ability to attract alliance partners (Eisenhardt and Schoonhoven, 1996; Park *et al.*, 2002). Because of the increased use of networking in numerous industries, resources are more and more embedded in interfirm networks (Gulati, 1999). Thus, the cooperative interorganizational relationships (IORs) that provide the focal firm access to such network resources can be perceived as a source of competitive advantage. This insight is emphasized in the *relational view* of strategic management (Dyer and Singh, 1998; Gulati *et al.*, 2000), which expands the unit of analysis from an individual firm or a single dyadic relationship to include the focal firm and all its interorganizational relationships.

From this perspective, the focal firm's competitive advantages resulting from its alliance portfolio can create relational rents. One of the determinants for relational rents worked out by Dyer and Singh (1998: 663) is the centrality of the focal firm in the industry network.⁶ The focal firm's position in important networks is shaped by the alliance portfolio's size (number of IORs) and structure (particularly the spread and redundancy of IORs). The benefits of the alliance portfolio to the focal firm depend not only on these structural properties but also on the characteristics of the individual interorganizational relationships (particularly their linkage strength). We refer to structural and relational characteristics of the

⁴ Koza and Lewin (1999), Doz (1996), and Mitchell and Singh (1996) have already used evolutionary theory to study alliances.

⁵ Connecting the resource-based view to concepts from evolutionary theory is considered to be a promising avenue for further research, because it allows management research that is firmly based in theory, methodically rigorous and, process-oriented (Foss, 1997; Montgomery, 1995).

⁶ The other determinants are relation-specific resources, routines for the information and knowledge exchange between cooperating firms, and effective governance of alliances and alliance management capability.

alliance portfolio as its configuration. The configuration of the alliance portfolio determines the position of the focal firm in the interorganizational field and the quality and quantity of external resources to which the focal firm has access, thereby influencing its development and performance.

To account for the structural and relational embeddedness of the focal company (Granovetter, 1985; Gulati, 1998), the theoretical underpinnings of our research are complemented by *social network approaches* (Burt, 1992; Coleman, 1990; Kogut, Shan, and Walker, 1992; Walker, Kogut, and Shan, 1997). From this perspective, a firm's alliance portfolio represents its social capital (Ahuja, 2000b; Bourdieu and Wacquant, 1992; Coleman, 1990; Koka and Prescott, 2002). Alliances open up new development opportunities by increasing the scale and scope of available resources beyond the boundaries of the firm, and they improve the legitimacy of the focal firm by including and influencing external stakeholders. Simultaneously, the firm's network of intertwined relationships also limits its development possibilities ('interorganizational inertia'; Mitchell and Singh, 1996; Walker *et al.*, 1997).

Occasionally both the resource-based approach and social network theories are criticized for having a predominantly static concept (e.g., Foss, 1997: 358). But recently, in both streams of research, promising efforts have given more attention to processes of change. Regarding resource-based reasoning, these efforts emphasize 'dynamic' capabilities that are designated to acquire, integrate, change, and abandon 'ordinary' resources and capabilities (Teece, Pisano, and Shuen, 1997), the accumulation and decay of resources (Dierickx and Cool, 1989), and the interplay of stock and flow of resources over time (Warren, 1999). Warren's dynamic resource system approach describes resource accumulation and mutual influence between the individual resources over time and can be modeled using Forrester's (1961) system dynamics method (reinforcing and balancing feedback loops).

To use relational resource-based reasoning for our process-oriented research, basic conceptual elements of the dynamic resource system approach—which fit well into our coevolutionary approach—are included in the theoretical framework of this study.

THEORETICAL PROPOSITIONS

Typology of alliance strategies

A fundamental task of multi-alliance management is the formulation and implementation of *portfolio strategy*, i.e., a strategy for the goal-oriented configuration and development of the alliance portfolio. Alliance portfolio strategies influence the focal firm's position in the interorganizational field, with the goal of improving the firm's resource endowment and legitimacy. Because developing the alliance portfolio coevolves with company and environment development, portfolio strategy has to stem from company strategy. In principle, corresponding to the distinction between corporate strategy and business strategy, portfolio strategies have to be designed and implemented at the corporate level and the business level. Because empirical evidence shows that, in a multi-business firm, the strategic alignment between company strategy and its alliance activities is mainly achieved at the business level (Hoffmann, 2005), we focus on business-level alliance portfolio strategies. At the business level, the task of alliance strategy is to strategically align all alliances of a business unit (division) with the business strategy. Different business strategies require different types of alliances (Rothaermel and Deeds, 2004). Alliance strategies, derived from the business strategy, determine the goals of all alliances of the business unit (e.g., developing a new technology or entering a new market) and the configuration of the business alliance portfolio.

By loosely connecting the firm and the environment, alliances can act as buffers, which help the focal firm master the problem of environmental uncertainty. Basically, there are three different strategies that allow firms to cope with a complex and changing environment (Ansoff, 1965; Wernerfelt and Karnani, 1987): reactively *adapting* to the changing environment, actively *shaping* the environmental development according to firm strategy, and *stabilizing* the environment in order to avoid organizational change. Both *adapting* and *shaping* strategies require exploration (March, 1991) to acquire new resources and capabilities. The *shaping* strategy, however, requires expanding and deepening the company's resource endowment in a focused manner, whereas the *adapting* strategy aims to increase strategic flexibility by broadening the resource endowment and generally improving

the ability to learn and change. The *stabilizing* strategy, on the other hand, relies on efficiently exploiting the existing resources (March, 1991) and protecting competitive advantages as much as possible.

Alliances can basically support implementing all three strategies:

1. *Shaping strategy.* Exploration alliances are entered into with the strategic intent to develop new resources and capabilities and to explore new development opportunities. Envisioned outcomes and paybacks are distant in time and generally exhibit higher uncertainty (Koza and Lewin, 1998). If the alliance strategy aims to actively shape the environment according to the firm's strategic interests, this goal requires a focused expansion and deepening of the resource base. We label the type of alliances that support this shaping strategy '*core exploration alliances*'. For example, pursuing shaping strategies, alliances are used to jointly develop new technologies (e.g., the development of the advanced photo system by Kodak, Polaroid, and Fuji) and to fundamentally improve product lines and service offerings to meet changing customer needs (e.g., in the airline industry, seamless global travel by alliance networks).
2. *Adapting strategy.* If the alliance strategy aims to reactively adapt to unfolding environmental dynamics, this goal requires broadening the resource base and increasing strategic flexibility by exploring new opportunities without making high and irreversible investments. In this case, firms typically establish several '*low-cost probes into the future*' (Brown and Eisenhardt, 1997: 16) using different alliances, and make selective follow-up investments depending on the development of important environmental characteristics. We label this type of alliances '*probing alliances*' or '*platform alliances*' (Kogut and Kulatilaka, 1994). For example, multiple parallel R&D alliances of incumbent firms with start-ups, often found in biotechnology, are used to increase strategic flexibility and overcome high technological uncertainty. Moreover, contractual alliances with local market partners are frequently used as an explorative step in entering a new market.
3. *Stabilizing strategy.* '*Exploitation alliances*' are entered into to commercialize resources and

capabilities gained through exploration (Koza and Lewin, 1998). They stabilize the environment and help refine and leverage the built-up resources to achieve a sustained and efficient exploitation of established competitive advantages. Examples of how market conditions can be stabilized to exploit and leverage existing resources are long-term supply contracts with customers (customer-supplier alliances), the use of alliance partners to open up new distribution and sales channels for established products, and collusion alliances among competitors.

Multiple alliances can also be used to combine the alliance strategies mentioned above. In situations with high environmental uncertainty, this kind of *hybrid strategy* helps to overcome trade-offs between exploration and exploitation as well as between actively shaping and reactively adapting when seeking new resources and capabilities.

Exploitation vs. exploration

Considering high strategic uncertainty, companies can either exploit the current resource endowment and wait to develop new resources and capabilities until uncertainty has been reduced or, through exploration, try to change the resource base and take earlier advantage of opportunities created by the environmental evolution. Alliances can help minimize this trade-off and create a balance between exploiting existing competencies and developing new competencies (Baden-Fuller and Volberda, 1998: 382). Alliances let firms explore new business activities step by step and develop new resources by making sequential investments at limited risk (Brown and Eisenhardt, 1997). Alliances provide real options (Kogut, 1991; Kogut and Kulatilaka, 1994) that enable firms to access additional resources, thus opening up (exploring) new development prospects. Once strategic uncertainty has been reduced, the option exists to completely acquire and integrate the cooperation unit or to make joint successive investments with the partner(s) (exploitation).

Actively shaping vs. reactively adapting

On the one hand, firms can actively reduce environmental uncertainty and influence how the environment evolves by developing and deploying their

resource base in a focused manner. Alliances help predict and influence the behavior of customers and competitors or help establish technical standards. On the other hand, firms can improve how they strategically adapt to unpredictable environmental developments by using their alliance portfolios to quickly and flexibly access different kinds of resources without making high and irreversible investments. By pursuing a hybrid strategy, a firm can use the majority of the investment to develop a specific capability while making small alternative investments, to hedge the bet in case other capabilities become critical to success. Examples of using alliances to implement such hedging strategy can be found particularly in high-tech industries (Wernerfelt and Karnani, 1987: 192).

Contingency factors determining alliance strategy

Ahuja (2000a) emphasizes that a firm's alliance activities can be explained by both inducement and opportunity factors. A firm's inducements to form alliances can be related to its need for resources (Eisenhardt and Schoonhoven, 1996). The larger the discrepancy between the company's current resource endowment and future demands from competition, and the more quickly and flexibly this deficit has to be overcome, the greater the strategic need for alliances.⁷ A strong inducement to form alliances comes from rapid and unpredictable change of the firm's environment and the accompanying high strategic uncertainty.

A firm's opportunities to establish new alliances depend on its position in the interorganizational field and its prior interorganizational relationships (social opportunities; Eisenhardt and Schoonhoven, 1996) as well as on its attractiveness to other firms because of its own resource endowment (Ahuja, 2000a). A firm's resource endowment in a specific business determines its ability to influence the strategic actions of important stakeholders and thereby its ability to shape the environment to fit its intended strategies.

⁷ Internal resource development and acquisitions provide alternatives to fulfill such deficiencies. Internally developing resources, however, does essentially require more time and acquisitions imply much higher investment and therefore the danger of high sunk costs. Furthermore, acquisitions can be hampered if the required resources are only a small part of the entire assets of the target company, and if there are restrictions from cartel regulations.

In line with these arguments, Figure 1 shows that the choice of an alliance strategy—and thus the configuration of the alliance portfolio—is contingent on the shaping potential of the focal company and on the strategic uncertainty it faces.⁸

The *shaping potential* of the focal firm is represented by its resource strength in the observed field of activity. Like Ahuja (2000a), we differentiate among three types of resources that can affect, and are affected by, a firm's alliance activities: (1) technical capital; (2) commercial capital; and (3) social capital. Technical capital represents a firm's capability to create new products, processes, and technologies (technological competence). Commercial capital is a firm's capability to commercialize developed products efficiently and obtain rents from them (marketing and administrative competence). The combination of technical and commercial capital builds a firm's competence base in a certain business. Technological and commercial competence comprises tangible and intangible assets as well as organizational capabilities used to acquire, apply, develop, and renew these assets. Social capital represents a firm's position in the interorganizational field. The benefits the firm accrues from its interorganizational relationships

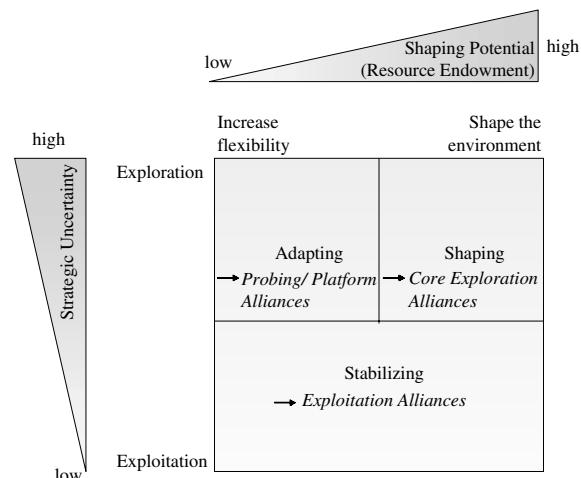


Figure 1. Types of alliance strategies

⁸ According to Wernerfelt and Karnani (1987), the decision whether to explore or exploit is also influenced by first-mover advantages and the decision whether to actively design or reactively adapt is also influenced by economies of scale and the risk preference of the decision makers. We, however, are going to concentrate on the two main influence factors that determine the strategy selected: shaping potential and strategic uncertainty.

include access to additional resources and assurance of legitimacy.

Strategic uncertainty is the uncertainty perceived by the firm's senior executives concerning the consequences of strategic decisions resulting from unclear environmental developments (Daft, Sormunen, and Parks, 1988; Duncan, 1972). The environmental uncertainty's type and extent are centrally important in strategic decisions. Environmental uncertainty usually is differentiated according to its source: regulative uncertainty, technological uncertainty, market uncertainty, and competitive uncertainty. Empirical studies prove that it is not the objective extent of environmental uncertainty but rather the subjectively perceived amount of environmental uncertainty that primarily influences the decision behavior (Huber and Daft, 1987).⁹ Thus strategic uncertainty can be defined as the perceived environmental uncertainty in relevant environmental sectors, weighted with the perceived relative importance of the individual sectors (Daft *et al.*, 1988). Additionally, the distinction between exogenous and endogenous uncertainty (Folta, 1998) is relevant to our study. Endogenous uncertainty can be influenced by the focal company's strategic actions, e.g., by alliances, while exogenous uncertainty depends on factors that cannot be influenced or modified by the company over time. The matrix shown in Figure 1 can be used to categorize individual alliances as well as alliance strategies. Positioning all alliances of a business unit in the portfolio matrix, depending on the strategic uncertainty and the shaping potential (resource endowment) of the focal firm in the area of cooperation, helps visualize the overall alliance strategy of a firm in a specific business. Since firms can implement hybrid strategies, a firm's alliance portfolio can comprise different types of alliances in one business.

High strategic uncertainty, because of environmental volatility and complexity, fosters exploration strategies through alliances (Park *et al.*, 2002), which can be used either to actively shape the environment according to the company's business strategy or to adapt the business development to the unfolding environmental changes. Both

modes of organizational change require exploring for new opportunities. Which alliance strategy is selected depends particularly on the company's resource strength in the field (Wernerfelt and Kurnani, 1987). The greater the company's technological and commercial competence and social capital in this business, the greater its shaping potential, and the more likely it is to prefer a focused way of exploration (shaping strategy). If, on the other hand, shaping potential is minimal, the company is forced to increase its strategic flexibility and to reactively adapt to the environmental evolution (adapting strategy). In any case, companies have to contribute some kind of technological or commercial strength if they want to enter into promising partnerships (Ahuja, 2000a).

Proposition 1: High strategic uncertainty and a low shaping potential—i.e., weak technological and commercial competence and minimal social capital—favor forging alliances to implement an adapting strategy to increase the strategic flexibility of the focal business unit and build up a broad set of new competencies and relationships.

Proposition 2: High strategic uncertainty and high shaping potential—i.e., strong technological and commercial competence and abundant social capital—lead to using alliances as a part of shaping strategies by which new resources are explored and immersed in a focused manner to actively shape the environment and reduce strategic uncertainty.

When there is less environmental uncertainty and dynamic, companies prefer exploitation strategies that deepen and exploit the resource base efficiently. In this context, business managers prefer exploitation strategies because they yield returns that are positive, proximate, and predictable (Koza and Lewin, 1998; March, 1991). Exploitation strategies can be supported by alliances that stabilize the business environment and leverage the built-up resources. Some authors argue that the main strength of alliances is found in their ability to quickly and flexibly explore new resources (Brown and Eisenhardt, 1997) and that, under conditions of low strategic uncertainty, firms prefer to exploit resources under unified control because of lower transaction costs (Hoffmann and Schaper-Rinkel, 2001). Empirical evidence shows that

⁹ But, of course, the more similar the perceived environmental uncertainty (*ex ante*) with the actual volatility of the environment (*ex post*), the better the choice of strategy and the performance of the company (Bourgeois, 1985).

firms engage in both exploration and exploitation alliances, depending on their business strategy. But resource-rich firms are more likely to establish exploration alliances than resource-poor firms and prefer to exploit existing resources on their own, if possible (Park *et al.*, 2002; Rothaermel and Deeds, 2004).

Proposition 3: In the case of low strategic uncertainty, alliances are used to exploit—i.e., refine and leverage—existing resources and to stabilize the business environment.

But there is not a unidirectional relationship between shaping potential (resource strength) and strategic uncertainty as independent variables, on the one hand, and alliance strategy as a dependent variable, on the other. The development of the resource endowment of a business unit and the strategic uncertainty it faces are also affected by the outcome of the firm's alliance activities. This interdependent relationship of contingency factors and alliance strategy represents how alliance portfolio, business strategy, resource endowment, and environmental changes coevolve. We take these interdependencies into consideration when we formulate propositions on the developmental course of alliance portfolios.

Configuration of alliance portfolios depending on alliance strategies

The alliance strategy determines the configuration of the alliance portfolio. Essential configuration parameters of alliance portfolios are the number, dispersion, and redundancy of the alliances plus their linkage strength (Granovetter, 1985; Kenis and Knoke, 2002; Rowley, Behrens, and Krackhardt, 2000).

The *number* of alliances determines the quantity (volume) of information and resources that a firm can access and acquire by virtue of its alliances (Koka and Prescott, 2002). The amount of accessible information and resources is also influenced by the position of the alliance partners in the interorganizational field and the partners' resource endowment.

Dispersion is the spread of alliances. Alliance portfolios with high dispersion tie the focal company to partners from different strategic groups and industries, i.e., to companies from different

clusters in the interorganizational field. Thus dispersion determines the diversity of information and resources that the company has access to with its alliances (Koka and Prescott, 2002; McEvily and Zaheer, 1999).

Redundancy is the contextual overlapping of alliances and increases with the density of the egocentric network of the focal firm. Interorganizational relationships are considered redundant if they give access to the same information and resources. Non-redundancy means that there are structural holes (Burt, 1992) between the focal firm's partners. The focal firm can exploit structural holes between its partners to gain control advantages (Burt, 1992). Furthermore, the lower the portion of redundant relationships in the entire alliance portfolio, the greater its efficiency, because the costs of developing and fostering the relationships are minimized (Burt, 1992; McEvily and Zaheer, 1999). On the other hand, redundant alliances reduce the dependency on individual partners and increase the reliability of obtained information (Kraatz, 1998).

The quality and richness of the information and resources that a company has access to via its alliance portfolio is primarily determined by the *linkage intensity* of the individual alliances (Koka and Prescott, 2002; Kraatz, 1998). Only strong ties, which have developed and been maintained over a longer period and which are supported by several people, enable a sufficiently close and trustful collaboration between companies, through which in-depth information and implicit knowledge can be shared (Coleman, 1990; Hansen, 1999). At the same time, however, a closer connection of companies linked by strong ties reduces their flexibility and can lead to interorganizational inertia (Mitchell and Singh, 1996).

The four parameters for configuring alliance portfolios determine (1) the quality, quantity, and diversity of information and resources to which the focal company has access, (2) the efficiency of the access to these network resources, and (3) the flexibility or stability of the focal company's position in the interorganizational field. According to Kogut (2000), companies can generate two different types of relational rents depending on how their alliance portfolio is designed. A company's alliance portfolio can have either partially redundant strong ties to similarly positioned alliance partners or non-redundant and predominantly weak ties to partners from different clusters in the interorganizational

field. In the first case, the alliance portfolio is intended to acquire what is known as a 'Coleman rent' (Kogut, 2000) by relatively stable alliances based on trust. In the second case, the alliance portfolio is meant to acquire what is known as a 'Burt rent' (Kogut, 2000) by bridging structural holes (Burt, 1992) and opportunistically optimizing the focal firms position in the network. Essentially, both strategies are extreme variants (corner points) in a continuum of possible strategic actions to balance the trade-off between, on the one hand, the richness of information and resources obtained and the stability of the alliance portfolio—strong and partly redundant ties to similar firms—and, on the other hand, the diversity of accessible information and resources and the flexibility of the alliance portfolio—predominantly weak and non-redundant ties to dissimilar firms. Burt (1998) also suggests that the two forms of social capital are not necessarily contradictory, but rather are valuable for different purposes and thus are favorable under different contingencies.

Considering this, how do the business strategy and the derived alliance strategy influence the configuration of the alliance portfolio? Within an *adapting strategy*, alliances give the business unit access to a wide range of information and resources with limited depth and reliability, to increase the breadth of resource endowment and to improve strategic flexibility. For this reason, adapting strategies emphasize a large number of alliances with greater dispersion (breadth) and less linkage intensity (strength) and redundancy (Brown and Eisenhardt, 1997; Rowley *et al.*, 2000).

Proposition 4: When companies pursue an adapting strategy in a specific business, then the business-related alliance portfolio is characterized by a large number of alliances with high dispersion and weak linkage intensity as well as low redundancy.

In *shaping strategies*, alliances allow for focused and in-depth access to definite information and resources with high reliability. This supports actively designing the business and environmental development according to the planned strategy. But this also requires coordination among the different alliances to utilize synergies and avoid conflicts. Compared to adapting strategy, shaping strategy has fewer alliances with less dispersion,

but higher linkage intensity and redundancy (Rowley *et al.*, 2000).

Proposition 5: When companies pursue a shaping strategy in a specific business, then the business-related alliance portfolio is characterized by a rather small number of alliances with rather low dispersion and rather strong linkage intensity as well as rather high redundancy.

In *stabilizing strategies*, alliances are used to refine and leverage existing resources and stabilize the environment. Exploitation alliances in mature industries are characterized by high linkage intensity and redundancy because the interorganizational field is stable and densely connected. As horizontal alliances they typically link a small number of strategically similarly positioned companies (collusion alliances), and as vertical alliances they link companies positioned at successive steps in the value chain (customer–supplier alliances). In the case of high partner-specific investments, however, acquisitions and mergers often provide a more efficient organizational long-term form for utilizing synergies among firms than alliances because of lower transaction costs (Williamson, 1991; Hoffmann and Schaper-Rinkel, 2001).

Proposition 6: When companies pursue a stabilizing strategy in a specific business, then the business-related alliance portfolio is characterized by a small number of alliances with low dispersion and strong linkage intensity as well as high redundancy.

Table 1 summarizes how the alliance strategy selected (shaping, adapting, stabilizing) determines the configuration of the alliance portfolio.

Developmental dynamics

Building on our theoretical insights, in a detailed analysis of how alliance portfolios evolve over time, the following parameters should be considered: (1) strategic uncertainty; (2) shaping potential (resource endowment); and (3) alliance strategy, i.e. configuration of the alliance portfolio. To analyze the effects of the evolution of alliance portfolios on firm performance, the focal business unit's financial performance also has to be included in this framework (see Figure 4). The visualizing technology of the dynamic resource systems

Table 1. Configuration of alliance portfolios determined by the type of alliance strategy

Configuration parameters of alliance portfolio	Adapting strategy	Shaping strategy	Stabilizing strategy
Number of alliances	Many	Rather few	Few
Linkage intensity of alliances	Weak	Rather strong	Strong
Dispersion of alliances	High	Rather low	Low
Redundancy of alliances	Low	Rather high	High
Stability of alliances	Low	Average	High

approach proposed by Warren (1999) can be used to illustrate interdependent cause–effect relationships between these parameters in the coevolution of a business unit, its alliance portfolio, and the environment. This technique applies system dynamics methods (Forrester, 1961; Sterman, 2000) and uses causal loop diagrams to visualize the stock and flow of company resources, their coevolution with internal and external contingency factors, and their performance consequences. We will use this technique in several steps to describe and explain how interdependent cause–effect relationships among environmental

uncertainty, resource endowment, alliance strategy (configuration of the alliance portfolio), and financial performance drive the development of a business unit, its alliance portfolio, and its environment.

Influence of contingency factors on the configuration of the alliance portfolio

The resource endowment of the focal firm in a business—comprising technological and commercial competence and social capital—is the main consideration by the dynamic resource system view. Inflows and outflows of resources alter this asset stock over time.¹⁰ Each resource stock is characterized by the depth (quality and richness) and breadth (quantity and diversity) of the resources available. The inflow and outflow of resources can change both the depth and the breadth of the resource stock. Thus, in Figures 2–4, we differentiate between the net inflow in new resources ('acquiring new competencies' and 'establishing new relationships'), which broadens the resource stock, and the net inflow in existing resources ('improving existing competencies' and 'improving existing relationships'), which adds depth to the resource stock. Figures 2–4 illustrate—step by step—how the

¹⁰ For the convenience of the reader we show only the net effect of inflows and outflows of resources.

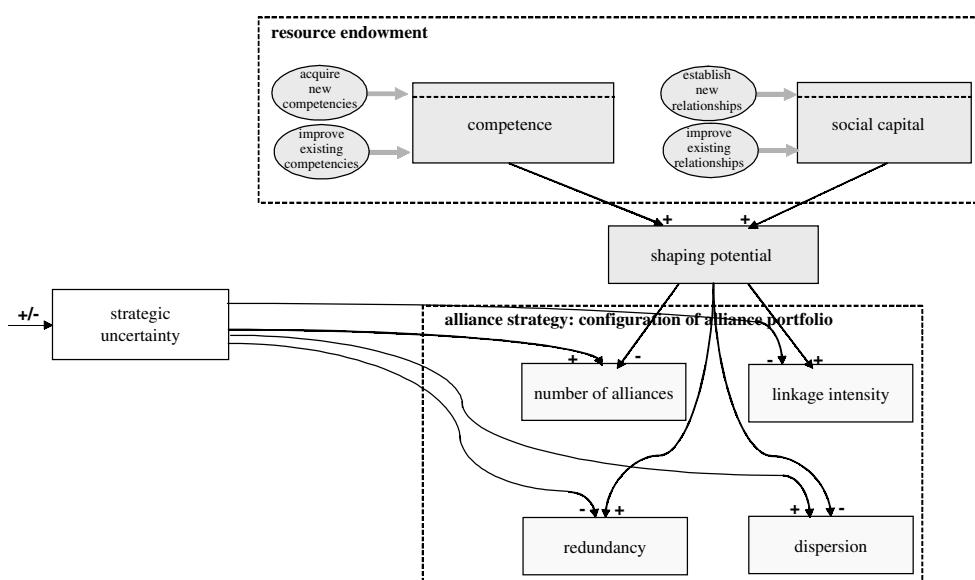


Figure 2. Influence of strategic uncertainty and shaping potential on the alliance strategy

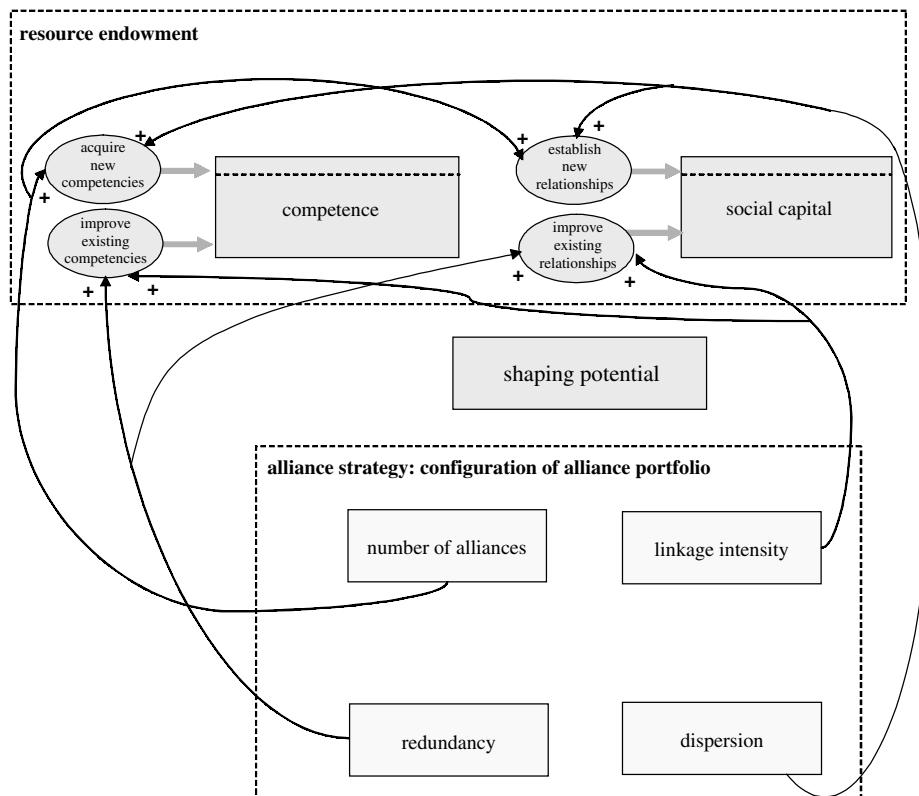


Figure 3. Influence of the alliance strategy on the resource endowment

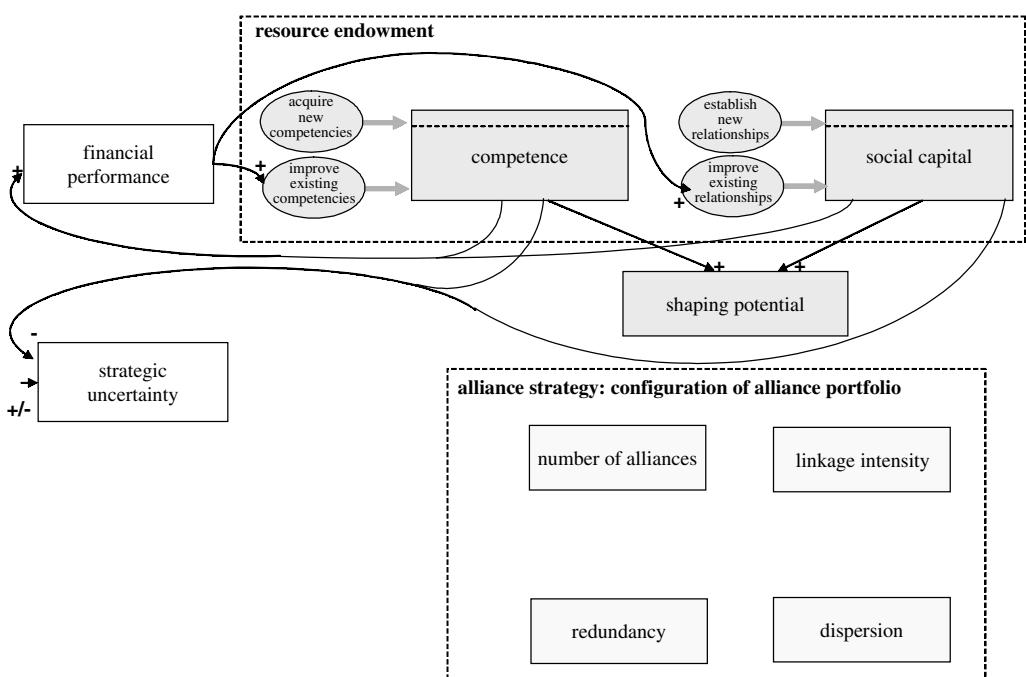


Figure 4. Influence of competence and social capital on the extent of strategic uncertainty and the shaping potential of the firm and on its financial performance

degree of strategic uncertainty and a business unit's asset stock influence its alliance portfolio and its financial performance and how the inflow and outflow of resources—and therefore the development of the asset stock—depend on the configuration of the alliance portfolio and the financial performance of the business.

How the configuration of a business-related alliance portfolio is contingent on strategic uncertainty and the resource endowment of the focal firm in this business has already been described and has led to Propositions 1–6. Figure 2 illustrates that high strategic uncertainty favors a larger number of alliances and greater dispersion of the alliance portfolio while negatively influencing linkage intensity and redundancy of the alliances (adapting strategy). High shaping potential—i.e., high technological and commercial competence and abundant social capital—promotes linkage intensity and contextual overlap of alliances, thus reducing the number and dispersion of alliances (shaping strategy). Accordingly, more shaping potential and less strategic uncertainty favor a small number of alliances with less dispersion and high linkage intensity and redundancy (stabilizing strategy).

Influence of alliance strategy on the resource endowment

A large number of alliances, with wide dispersion, fosters the creation of new capabilities and relationships, thus broadening a business unit's resource endowment and increasing its strategic flexibility. This not only increases the quantity and diversity of the stock of capabilities and relationships but can also lead to a fundamental structural change of the resource endowment of the business unit. Conversely, high linkage intensity and redundancy of alliances improve existing capabilities and deepen social capital with existing partners, thereby increasing the depth (richness) of the business unit's resource endowment. This leads to increased quality in the stock of capabilities and social capital (see Figure 3).

Influence of resource endowment on shaping potential, strategic uncertainty, and performance

The quality and richness of the resource endowment determine the shaping potential of a firm in a specific business and also influence—along with

exogenous factors—the strategic uncertainty. The better the information and the richer the resource endowment of the focal company in this business, the less endogenous strategic uncertainty remains. As shown above, when there is low strategic uncertainty and high shaping potential, companies prefer exploitation strategies and integrating (terminating) existing exploration alliances. Within exploitation strategies, usually only a few alliances are implemented to stabilize the environment and to refine and leverage existing resources. This means that the success of an alliance strategy—i.e., overcoming and reducing strategic uncertainty and building a superior asset stock step by step—leads to its own termination (balancing loop;¹¹ see Figure 4).

Figure 4 also shows that the profitability of the focal company's business depends on the depth (quality) of its capabilities and the social capital in its field. Above-normal returns require a resource endowment superior to that of competitors (capability advantage and/or privileged interorganizational relationships).¹² Superior financial performance positively affects the resource endowment, because financial surpluses allow additional investments, and there is an incentive to continue to invest in successful business models (reinforcing loop; see Figure 4).

Synthesis: Development paths and stages

Combining the described cause–effect relationships to create an overall picture allows identification of development paths and development patterns of alliance portfolios: high strategic uncertainty favors cooperation strategies to explore new capabilities and relationships. If a company's shaping potential in the field of cooperation is weak, it has to pursue an adapting strategy, i.e., entering into a larger number of probing alliances with greater dispersion. The number and dispersion of the alliances positively influence the creation of new capabilities and relationships. Thereby the probing alliances enable the firm to broaden its capabilities and relationships and to increase its

¹¹ Balancing loops have an odd number of negative correlations. Reinforcing loops are either exclusively positive correlations or have an even number of negative correlations (Sterman, 2000: 143f).

¹² Of course, there also exist other factors influencing firm profitability in a specific business, especially market conditions, intensity of competition, and regulatory constraints.

strategic flexibility. Increasing the diversity and quantity of available resources is necessary for the firm to maintain its competitiveness in a fundamentally changing business environment. When a firm has successfully used probing alliances to improve its resource endowment in this business but is still facing rather high environmental uncertainty, it will switch from implementing an adapting strategy to pursuing a shaping strategy, i.e., one that reduces the number and dispersion of alliances and increases contextual overlap and linkage intensity of the remaining core exploration alliances. This shift in strategic direction stems from the preference of business managers to shape the environment in accordance with their strategic goals, if they have the power and resources to do so.

The remaining core exploration alliances, because of their increasing importance and redundancy, need to be coordinated more intensely by the focal firm than when they were part of an adapting strategy.

Proposition 7: In the course of an adapting strategy, new competencies and social capital are created. The resulting step-by-step increase in shaping potential fosters a change from an adapting to a shaping strategy as long as environmental uncertainty is still high.

The resource endowment that has been improved by use of exploration alliances increases the shaping potential of the business unit and leads to a rebalance between the resource stock and the changed environmental requirements. At the same time, this step-by-step process of mutual adaptation between business strategy and resource endowment, on the one hand, and environmental characteristics, on the other, reduces the remaining endogenous strategic uncertainty. As resource endowment improves and strategic uncertainty decreases, the need to cooperate and the number and dispersion of alliances are reduced. Over time, the company's strategy in this business will change from shaping to stabilizing, thus helping the business unit exploit the newly acquired resources. Exploration alliances are terminated step by step, and the developed resources are transferred to the parent organization, where they are replicated. The redundancy and linkage intensity of the remaining, or newly established, exploitation alliances continue to increase. These interorganizational relationships are used to stabilize the environment and

to protect and leverage the competitive advantages developed.

Proposition 8: In the course of a shaping strategy, existing competencies and social capital are augmented and improved. The resulting step-by-step decrease of strategic uncertainty fosters a change from a shaping to an exploration (stabilizing) strategy.

The proposed development of alliance strategies over time, however, means that the company's strategic flexibility in the focal business decreases after the strategic uncertainty is resolved, and no more new capabilities and relationships are created because the focus is on deepening and exploiting existing ones. But any rise in exogenous strategic uncertainty (e.g., the entrance of a new competitor, technological innovations or deregulation) increases the need to cooperate again to enhance strategic flexibility. Therefore, including changes in exogenous uncertainty, this development loop is balancing. This means the development path identified is not a one-way street from adapting to exploiting because exogenous changes can again lead to a sudden increase in environmental uncertainty and cause a switch of strategies back from exploitation to exploration.

Figure 4 illustrates that the profitability of a business is determined by a company's competitive position (resource endowment) in this field. The quality (depth) of a company's endowment with competition-relevant capabilities and relationships influences financial performance positively. The profitability of the business has a positive influence on further investments to increase the existing stock of resources and relationships. This reinforcing loop means that the earnings produced using the established business model tend to be invested in improving that business model and refining the existing resource endowment. This investment behavior, often found in practice (Koza and Lewin, 1998: 257), can be dangerous and lead the company into what is known as the competency trap (Levinthal and March, 1993). A sudden increase in the strategic uncertainty caused by environmental changes that cannot be controlled by the focal company can quickly destroy the value of these capabilities and the relationships the company has built up. In such a case, the company would not be able to cope with the modified environmental conditions in this business because it has invested

primarily in refining proven resources and not in broadening its resource base. If the effect of the reinforcing loop (maximization of the short-term financial performance) is stronger than the effect of the balancing loop (timely renewal of the resource base when facing increasing strategic uncertainty by entering into new exploration alliances), the company can lose its competitiveness in a changed business environment.

Assuming a decreasing strategic uncertainty in the course of industry evolution and considering the identified cause–effect relationships, one can detect an ideal development path for alliance strategies, namely from adapting, to shaping, and to stabilizing strategies. These three strategy types represent developmental stages in the evolution of alliance portfolios. In the course of evolution from adapting to shaping and stabilizing strategy, the number of alliances decreases continuously. At the same time, the linkage intensity increases, because secondary (probing) alliances are turned into primary (core) alliances. The dispersion of the alliance portfolio decreases due to increasingly focused investment behavior. In the meantime, the redundancy of the relationships increases because the remaining alliances of the focal business unit—as well as the whole industry (interorganizational field)—become more closely interconnected, thereby eliminating structural holes.

But the developmental pattern identified does not represent a linear and deterministic life-cycle model because it allows for different development courses when firms are confronted with an exogenous change in environmental uncertainty in a business, depending on the company's strategic response. When facing an increase in strategic uncertainty, the business unit can either continue to pursue an exploitation strategy, according to the reinforcing loop, or switch to an exploration strategy, according to the balancing loop. In the first case, short-term profit maximization is emphasized; in the second case, the desire to safeguard the long-term viability of the business unit dominates. Thus the outcome of the coevolution of a firm's business strategy, its alliance portfolio, and the environment depend on both uncontrollable (random) events and the strategic choice of the responsible business managers.

Proposition 9.1: As long as the development of a business (an industry) is combined with diminishing strategic uncertainty, (1) the number and

dispersion of the alliances of a firm in this business decrease and (2) the linkage intensity (strength) and the redundancy of the alliances increase.

Proposition 9.2: When exogenous environmental changes increase strategic uncertainty, the alliance strategy will switch back to exploration if more emphasis is given to long-term viability of the business than to short-term profit maximization.

When the alliance strategy switches back to exploration, the evolution of the alliance portfolio again starts to move along the developmental path stated in Proposition 9.1.

The trade-off between short-term profit maximization, via efficient exploitation of existing resources, and securing long-term viability, via exploring for new resources and opportunities, can be overcome by using hybrid strategies. By pursuing such strategies, business units can exploit existing resources efficiently while developing new resources for changing environmental conditions.

Proposition 10: Hybrid alliance strategies can help balance the trade-off between short-term profit maximization and long-term viability of a business unit by building new resources and capabilities to cope with environmental change without harming the efficient exploitation of existing resources and capabilities.

According to the proposed developmental pattern and stages of alliance strategies, the typical development path of a *single* exploration alliance starts as a probing or platform alliance. Then it develops into a core alliance, and—when the strategic uncertainty is resolved—either ends with the termination of the alliance or is transformed into an exploitation alliance. Of course, an exploration alliance does not have to go through all developmental stages. For example, it can be set up as a core exploration alliance from the beginning. When the alliance strategy switches from exploration to exploitation, not only the exploration alliances are terminated or transformed to exploitation alliances, but also new exploitation alliances can be set up.

METHODS AND DATA

Research strategy

According to the research question—describing and explaining developmental paths and patterns of alliance portfolios—we have followed a descriptive and explanatory research strategy. We first derived a set of propositions from established theories and previous empirical studies. Secondly, guided by the theoretical framework, we did two comprehensive longitudinal case studies to investigate the propositions (multiple case design; Yin, 1994).

The empirical inquiry was not intended to put the theoretical propositions through the rigorous test of a large empirical study. At this early stage of research, the empirical study should be more exploratory and process-oriented. Its objective is to illustrate the developed theoretical propositions and to see how well they correspond with reality—to challenge, confirm, or extend and refine the proposed theoretical framework. In other words, the results of the case studies provide a test of the usefulness of the framework and not a rigorous test of the external validity of the developed propositions.

Case studies are well suited to support explanatory research strategies because they allow us to trace operational links between variables over time (Yin, 1994: 6). Case studies allow an in-depth analysis of complex (inter)organizational development processes and an examination of the rich context of the inquiry object (Lee, 1999; Yin, 1994). Recently, case studies have been used quite often in alliance research, especially when processes of change have to be analyzed (Arino and de la Torre, 1998; de Rond and Bouchikhi, 2004; Doz, 1996; Koza and Lewin, 1999). Koza and Lewin (1999) view longitudinal case studies as unique opportunities for empirical and theoretical interpretation and a means of developing an evolutionary understanding of alliances. In the majority of the papers, the case studies were used to generate new theory according to the grounded theory approach (Glaser and Strauss, 1967; Eisenhardt, 1989).¹³ But authors have also increasingly been using case studies to illustrate theoretical propositions and to elaborate

on and extend existing theories (Bogenrieder and Nooteboom, 2004; de Rond and Bouchikhi, 2004; Maitlis, 2005; Monge *et al.*, 1998).

In our study, the two cases are intended to serve as an empirical illustration to support or question the conceptual ideas developed in the theory section, and not as a dataset from which to develop new theory.

Even though not all scholars accept the illustrative and explanatory use of cases in management research, we chose this research strategy because—compared to other methods—it offers several advantages. Compared to inductive theory generation (grounded theory approach), propositions are better anchored in established theory and less dependent on the specific case context (Eisenhardt, 1989: 547). In addition, case selection, data collection, and data analysis all benefit when they are guided by a theoretical framework that has been developed before the case studies are done (Yin, 1994: 13).

The advantage of this methodology over a broad study, with multiple observations that tests hypotheses using sophisticated statistical methods, is that it lets us analyze the development of alliance portfolios in greater depth and explicitly consider the rich context of the study (Lee, 1999).

Unlike purely theoretical research papers, our procedure also offers initial empirical evidence as to whether the developed theoretical framework would be practically relevant, thus allowing us to generate proposals for improving the propositions.

Analytical techniques

To carry out the case studies, we followed the procedure proposed by Yin (1994: 49). We first developed the theoretical framework and formulated propositions that were used to guide data collection and analysis. Then we selected the cases and conducted the case studies. Building on the data gathered, we performed within-case and cross-case analyses. To illustrate how the alliance portfolios of both investigated business units developed, we used the portfolio technique presented in Figure 1. We compared the findings of the two case studies against our propositions (qualitative pattern-matching; Yin, 1994: 106) to either find preliminary support for the proposed relationships or to revise the propositions if they did not correspond to reality. Because of our theoretical framework,

¹³ Generally speaking, case studies can be used to generate theory, provide description to existing theories, elaborate and extend on theories, and test theories (Eisenhardt, 1989: 535; Yin, 1994: 3f).

we were especially interested in analyzing time-series data and chronologies, i.e., sequences, contingencies, time lags, and distinctive time periods in alliance portfolio evolution (episodes, developmental stages). Finally, we tried to identify starting points that would allow us to refine and extend the proposed theoretical framework.

We took the following measures to assure the validity and reliability of our findings (Yin, 1994: 33). To make sure that the construct validity is high, we relied on multiple sources of evidence and had our key informant repeatedly review the case study reports. To assure internal validity of the findings, we performed qualitative pattern-matching analysis. External validity of the findings is limited because we studied only the development of the alliance portfolio of two businesses in one company, which allowed for only one literal replication of the findings. To assure reliability, we used an elaborate case study protocol and continuous case documentation utilizing a case study report and a case study database.

Research setting and data sources

In collaboration with Siemens, we studied the development of the alliance portfolios of two selected business units for the period from 1990 to 1999 in retrospect. These business units are 'rail and transport systems' and 'fossil energy production.' Cases were chosen for three reasons: (1) good accessibility and documentation of the required data (formal alliance management); (2) far-reaching changes in the industries resulting in high strategic uncertainty in most of the period studied; (3) both business units, affected by the changing environment, underwent fundamental strategic changes in which alliances were of key importance.

For the 1990s, we studied which portfolio strategies Siemens implemented in the two businesses and how these strategies coevolved with corporate and business strategies and environmental changes, and we analyzed the performance consequences of the alliance activities. To assure that we captured the rich context in which the alliance activities took place, we collected abundant qualitative and quantitative data. First we analyzed all the data and documents available in the archive. In addition, we did 15 partially structured interviews with six

senior executives at Siemens. Two of the executives were responsible for the overall coordination of Siemens' alliance activities, and two others were each responsible for one of the two business units investigated. Interviews lasted an average of 2 hours and were tape-recorded and transcribed. The transcribed material was reduced and condensed corresponding to the variables and constructs stated in the theoretical framework (Miles and Huberman, 1994).

The collected data were documented continually as a case-study report and then checked by the main contact at Siemens, the vice president of strategic alliances. In the case-study report, the data were structured in chronological order separating environmental, action (strategy choices and configuration of alliance portfolio), and outcome categories (see Appendix for an excerpt).

Variables

We collected quantitative and qualitative data for a large number of variables illuminating the phenomenon of interest and its context. In the following, we specify the core variables used to illustrate and examine the propositions developed.

Resource endowment (shaping potential)

The firm's average resource strength in the field of cooperation was determined using three resource dimensions: technological competence, commercial competence, and social capital. The yardstick used by our contacts at Siemens in (subjectively) evaluating the resource strength was the extent of the current resource stock compared to strategic requirements (and *not* compared to the firm's partners). A seven-step ordinal scale was used to measure each dimension.

Strategic uncertainty

The perceived strategic uncertainty was basically analyzed according to the four dimensions (1) regulative uncertainty, (2) technological uncertainty, (3) market uncertainty, and (4) competitive uncertainty, to create a weighted arithmetic mean value. This approach to operationalizing strategic uncertainty has proven itself in several empirical investigations (Elenkov, 1997; Sutcliffe and Zaheer, 1998). The relevant dimensions of uncertainty were selected to evaluate a particular alliance.

For market alliances, these are market uncertainty, competitive uncertainty, and regulative uncertainty (weighted 33.3% each). For technology alliances, these are technological and regulative uncertainty (weighted 50% each). The individual value for each dimension of uncertainty was determined from subjective estimates by the responsible senior executives at Siemens, using a seven-step ordinal scale. The yardstick used for the evaluation was the predictability of the future development of this sector of the environment.

Alliance portfolio configuration

The configuration of the alliance portfolio was described using four parameters: (1) number; (2) dispersion; (3) redundancy; and (4) linkage intensity of alliances. First we analyzed the documents to appraise the parameters. With regard to the number of alliances, we distinguished between contractual alliances, joint ventures, and minority equity stakes. Then, to refine our estimates, we interviewed the responsible senior executives from Siemens. They evaluated the dispersion, redundancy, and linkage intensity using a simple three-step ordinal scale (low, medium, or high).

Financial performance

To evaluate the financial performance of both business units, we used the following accounting data: net operating profit after taxes (NOPAT) and return on capital employed (ROCE). For reasons of confidentiality, the exact performance values cannot be published. We are limited to characterizing the performance over time as 'below industry average,' 'at industry average' or 'above industry average.'¹⁴ We also assessed Siemens' market share in both businesses compared to its largest competitor (relative market share) and used this as an indicator for Siemens' competitive position.

FINDINGS

We use the longitudinal data gathered to analyze the course of development of the Siemens alliance

portfolios in both businesses. A chronological list of all important events in the development of the two investigated alliance portfolios is found in the Appendix.¹⁵

In the period studied, the strategic new alignment of Siemens' *fossil energy production* was supported by:

- (a) developing a new large gas turbine as a leading project to acquire additional technological knowledge;
- (b) developing new markets (in particular, the United States and the Far East).

In the first half of the 1990s, the alliance strategy was to set up a network of learning alliances to develop the new large gas turbine ('steelstar,' 'blade-coating,' 'turbinepower,' 'thermostar'). The goal of these alliances was to minimize the high technological uncertainty in the borderline area of thermodynamics and to acquire required new technological capability for successfully developing the new gas turbine generation. In the second half of the investigated period, the learning alliances progressively became core exploration alliances that, with jointly coordinated technology development, helped Siemens achieve a prime position in gas turbine construction. On the market side, the emphasis was on stabilizing market conditions and exploiting established market positions in mature markets (Europe and the United States, using acquisitions and informal agreements) and on doing flexible reconnaissance in emerging 'uncertain' markets, like joint ventures in China and India. From the beginning, the alliance strategy in fossil energy production was to broaden expertise in turbine construction and later to combine a shaping strategy (focused technological innovation) with the flexible exploration of emerging markets.

After successfully developing and marketing the new gas turbine, the 'steelstar' partner was acquired as a whole, because the joint expertise built up was strategically very significant to Siemens and was the most valuable asset of this company. The 'turbinepower' and 'thermostar' alliances were terminated once the goal of the

¹⁴ The financial contribution of the alliances to the overall performance of the businesses could not be isolated because the alliances in both businesses were integrative components of the business model.

¹⁵ All our studies concentrate on strategic alliances. In addition to strategic alliances, Siemens also had a large number of operative cooperation projects during the investigation period, in particular in the form of consortia and what are known as local-content joint ventures, designed to realize individual projects.

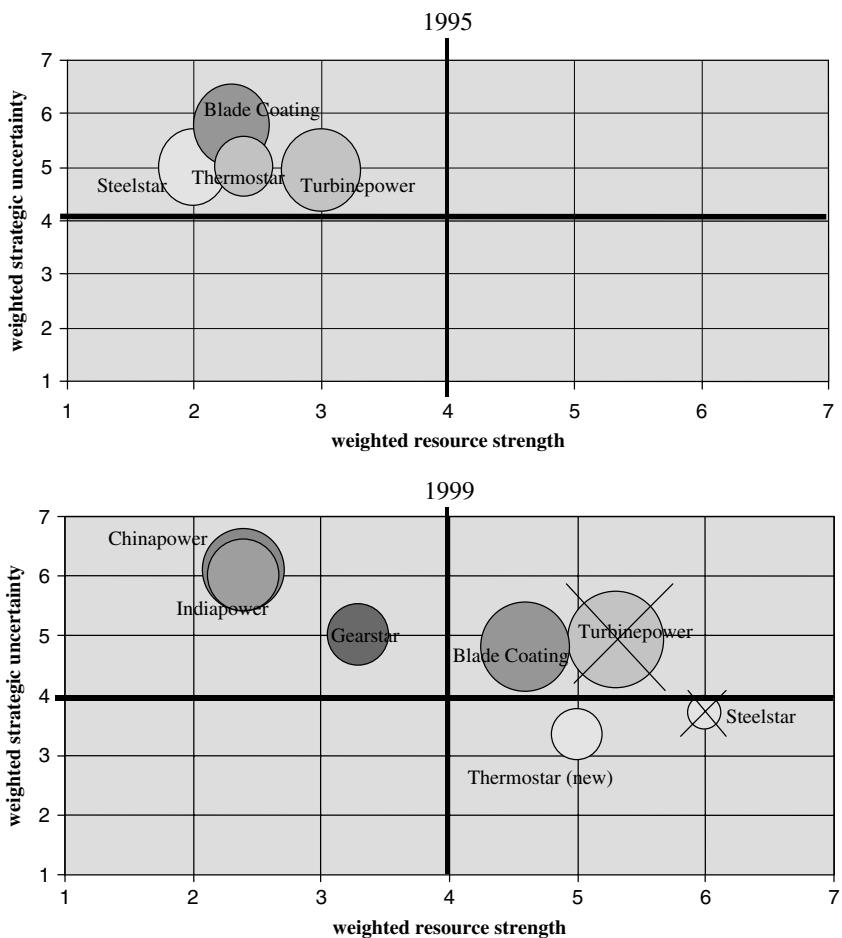


Figure 5. Development of the alliance portfolio of fossil energy production in the period investigated

cooperation had been attained. The trust relationship between Siemens and the 'thermostar' partner, however, was used to start a new joint project: outsourcing part of the turbine maintenance to the proven partner ('thermostar (new)').

The evolution of the alliance portfolio can be illustrated using the portfolio technique we developed in Figure 1. Positioning all alliances of the business unit in the portfolio matrix for different years, depending on the strategic uncertainty and the shaping potential (resource endowment) of Siemens in the area of cooperation at these times, allows us to categorize individual alliances and to visualize the development of the alliance strategy of Siemens in the fossil energy production business in the period studied (see Figure 5).

Figure 5 shows that in 1995 Siemens, on the technology side, followed an adapting strategy in fossil energy production that developed little by

little, to a shaping strategy. While the alliances 'blade-coating,' 'steelstar,' 'thermostar' and 'turbinepower' developed from probing to core exploration alliances, Siemens' controlling influence and the intensity of coordination among individual Siemens alliances increased. Once the uncertainty of developing and introducing the new gas turbine to the market was basically resolved, most of these technology alliances were either terminated or the partner firms acquired. To exploit the newly established competitive advantage in the gas turbine business efficiently, an outsourcing alliance was created (stabilizing strategy). By 1999 this evolution of the alliance portfolio was complemented by the exploration of new markets, using two joint ventures in China and India.

The configuration of the alliance portfolio developed according to the alliance strategies pursued. In the first years of our study, when Siemens

implemented an adapting strategy, the number of technology alliances increased. Siemens' partners all came from different regions of the interorganizational field, and the intensity and intimacy of collaboration with the partners was relatively weak. When the alliance strategy developed from adapting to shaping, the linkage intensity increased: trust between Siemens and its partners developed, and the scope and intimacy of the collaboration increased. But in the first phase, the number and dispersion of alliances remained unchanged. Only in a second phase, when some technology alliances were terminated, did the number and dispersion of exploration alliances decrease. At the same time, however, Siemens' alliance strategy was complemented by exploring new markets, and new platform alliances were set up in China and India. When Siemens moved from a shaping to a stabilizing strategy on the technology side, all exploration alliances were terminated. With one of these partners, Siemens established an exploitation alliance. Thus, when Siemens moved from exploring a new technology to exploiting it, the number and dispersion of alliances dropped considerably, and the tie with the remaining exploitation partner was strengthened. But, since Siemens had only one exploitation alliance in this business when our period of study ended, there was no redundancy between exploitation alliances.

The strategic new alignment of the *rail and transport systems* business by Siemens concentrated on:

- (a) flexibly and quickly acquiring technological competencies in new areas;
- (b) coordinated development, with partners, of new transport and traffic systems;
- (c) developing new markets.

From the beginning, the main aim of the alliance strategy in this business was to acquire new technological competencies and flexible access to additional production capacities in mechanics. Siemens acquired minority equity stakes in companies with leading production technology ('Duewag,' 'Krauß-Maffei'), which slowly developed into a network of core exploration alliances. In the second half of the investigated period and based on an improved resource position as a provider of a total technology solution package, Siemens pursued a shaping strategy by successively increasing its equity

stakes and finally integrating the acquired investment (transformation from shaping to stabilizing strategy). On the market side, this alliance strategy was complemented by actively shaping the market in high-speed trains and innovative transport and traffic systems ('ICE3 consortium,' 'Ansaldo,' 'Matra'). In the United States, a contractual customer-supplier alliance was established with GM to stabilize the sale of electric railroad motors. The shaping/stabilizing strategy in the core business was complemented by cooperative marketing ventures in new areas (especially 'Eurotrain') and by making probing alliances in software (especially 'CTS').

To resolve performance problems and develop the 'Matra' alliance consistent with Siemens' strategic interests, Siemens took over 'Matra' as a whole. The platform alliance with Toshiba for operations in the Japanese market was terminated because the market prospects could not be utilized.

Figure 6 illustrates how, over time, an adapting strategy develops into a shaping and then a stabilizing strategy. During this course of development the linkage intensity of the individual alliances clearly increased, as did the coordination intensity between alliances. For example, Siemens established its own management holding for the coordinated governance of all the shareholdings in this business. At the end of this development process, the shareholdings were completely taken over and integrated into the Siemens core organization. The figure also shows how shaping strategies (1995) and stabilizing strategies (1999) can be complemented by technology and market exploratory alliances (probing and platform alliances) to hybrid strategies. Siemens uses these hybrid strategies to exploit its strong market position as a bidder that can efficiently offer a total rail system package in its core business while remaining flexible in exploring new market and technological opportunities.

As proposed, the redundancy of the alliances increased while the alliance portfolio evolved from adapting to shaping as a result of diminishing structural holes between the partners. The structural holes diminished because Siemens had directly linked its core exploration partners to better coordinate implementing the alliance strategy. It is apparent, however, that the dispersion of the alliances decreased further as the alliance strategy evolved from shaping to stabilizing, but their redundancy did not further increase as proposed. In

in this particular case, this lack of increase occurred because the redundancy strengthening effect of the decreasing alliance dispersion is counterbalanced by the redundancy attenuating effect of the decreasing number of alliances.

DISCUSSION

Figures 5 and 6 illustrate how alliance strategy changes in alignment with the overall business strategy and the business environment. As the main

factors that influence the development of alliance strategies, we have identified, in the theory section, resource strength (shaping potential) and the extent of strategic uncertainty. Comparing the developed propositions with the empirically stated courses of development of alliance portfolios reveals the following insights:

According to Proposition 1, at the beginning of strategic reorientation—when strategic uncertainty was high and the required resources for future success were not available—several probing and platform alliances were initiated in both

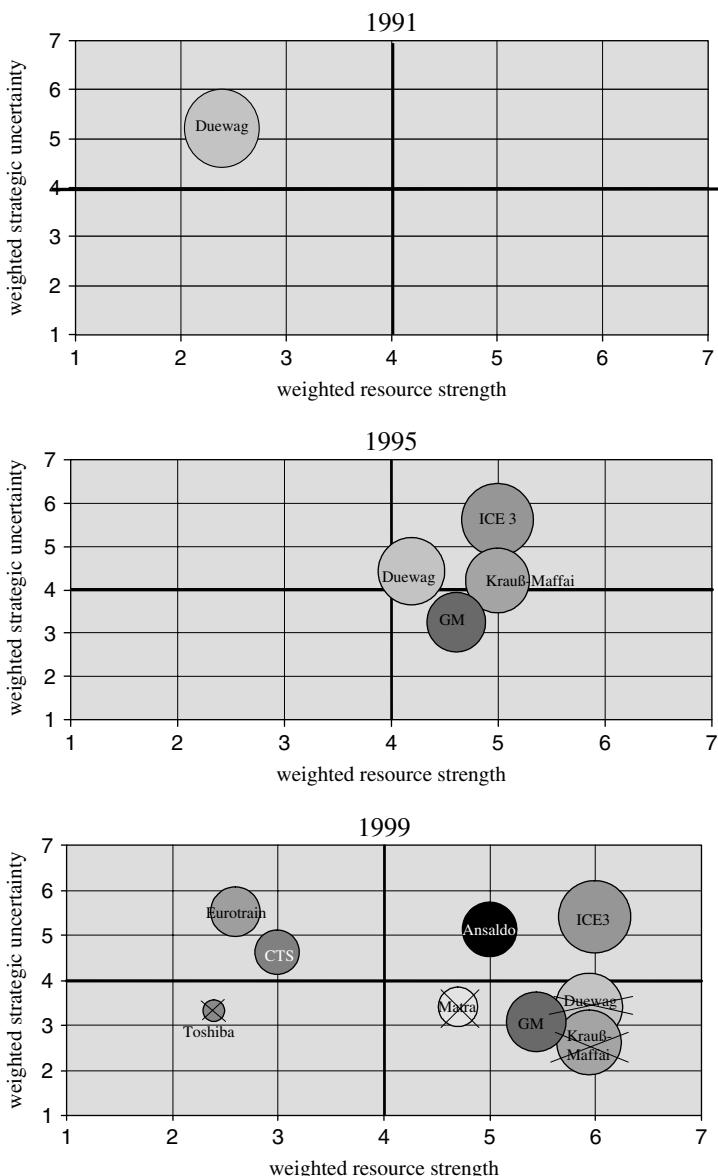


Figure 6. Development of the alliance portfolio of rail and transport systems in the period investigated

business units. In both businesses, a fundamental change in the business environment led to a shift in strategy that clearly increased exploration activities using alliances. These exploration alliances increased the strategic flexibility of Siemens, and they produced a fundamental broadening of the resource and knowledge base in the focal business units. The implementation of an adapting strategy enabled Siemens to strategically redirect both businesses facing tremendous changes in the regulatory, competitive and technological environment.

In line with Proposition 4, the adapting strategies led to alliance portfolios characterized by high dispersion and low redundancy of the alliances, and the linkage intensity of the interorganizational relationships was relatively weak. At the beginning of the period, we studied several alliances with dissimilar firms with distinctive capabilities, which were managed independently of one another. Most alliances were only on a contractual basis. Since the partner firms came from different parts of the interorganizational field, they were separated by structural holes. With its alliance strategy, Siemens was able to act as a central link and information broker among these other firms, thus creating both information and control advantages (Burt, 1992).

Building on the success of the adapting strategies, as implied by Proposition 2, both businesses shifted to shaping strategies complemented by new probing alliances in areas in which Siemens still had a weak resource position. When Siemens changed from an adapting to a shaping strategy, the variety of exploration activities was reduced and the core exploration alliances were focused to actively shape the environment according to the strategic interests of Siemens. But to be able to actively influence important environmental sectors by a focused development and deployment of the resource endowment, Siemens needed to first increase its shaping potential using probing alliances.

When the portfolio strategy was changed from adapting to shaping, the linkage intensity of the remaining alliances increased, and the interconnectedness of the alliances was reinforced in both businesses (see Appendix). To actively shape the environment, Siemens concentrated on core exploration alliances that were tightly coordinated to assure that the overriding strategic business goals would be achieved. This finding clearly shows that the need to control alliance development and to

coordinate among different alliances in one business is higher with a shaping strategy than with an adapting strategy. This empirical finding is in accordance with Proposition 5.

When the strategic uncertainty decreased in the two businesses studied, exploration alliances were terminated step by step, either by dissolving and transferring the resources built in the alliance to the parent organization, or by acquiring and integrating the cooperation unit into the parent organization. In addition, in both businesses, new exploitation alliances were set up, which helped refine and leverage the established superior resource stock and stabilize the business environment (see Proposition 3).

In line with Proposition 6, only a few alliances were established to implement the stabilizing strategy, and these alliances were characterized by strong linkage intensity and low dispersion. At the same time, however, Siemens reacted to the emergence of new markets and technologies by entering into new probing alliances to explore these opportunities with limited risk. Thus Siemens complemented the stabilizing strategy with an adapting strategy to explore new growth opportunities in both businesses (hybrid strategy). That is why the overall number of alliances in the two portfolios studied, as well as their dispersion, was still relatively high at the end of the investigated period.

Developments in the rail and transportation industry as well as in the fossil energy production industry—both mature industries in highly developed countries—in the period studied provide illustrative evidence that is in line with Propositions 3 and 6. With the help of customer/supplier alliances (e.g., ‘GM’ and ‘thermostar (new’)), cost advantages are created and customer relationships stabilized. In both businesses, the few companies that dominate the world market are also linked by supplier relationships, and merger talks repeatedly take place between the companies.¹⁶ But interviews conducted during the study showed that cartel regulation restrictions and a lack of desire to sell by the target company’s owners are particularly important barriers to mergers and acquisitions. These findings support our proposition that, when there is low or decreasing environmental

¹⁶ For example, at the end of the investigation period, intensive merger negotiations between Siemens and Bombardier took place to pool their rail and transportation system business. These merger talks finally failed and Bombardier teamed up with Adtranz, Siemens’ major European competitor.

uncertainty, market-dominant companies will form stabilizing alliances, especially if acquisitions or mergers among these companies are difficult.

But one observation is not completely in accordance with Proposition 6: in both cases studied, the redundancy of the alliances did not further increase when the portfolio strategy changed from shaping to stabilizing. In both cases, the decreasing number of alliances has counterbalanced the positive effect of the decreasing dispersion of the core alliances (exploitation alliances) on the redundancy of the alliance portfolio. It appears that the redundancy of alliances is not greater with stabilizing strategies than with shaping strategies, if the number of exploitation alliances is limited. A primary reason for a small number of exploitation alliances could be the focal companies' desire for efficiency. Implementing and caring for interorganizational relationships requires considerable effort, so efficient egocentric networks should have minimal redundancy (Burt, 1992). Particularly, large firms seek to minimize transaction costs by exploiting their superior resource endowment without alliance partners (Rothaermel and Deeds, 2004).

The evolution of both investigated alliance portfolios illustrates how—according to Proposition 7—successfully implementing an adapting strategy will later lead to a strategic change into a shaping strategy. If the focal company succeeds in adapting its stock of resources to changed environmental requirements with the probing and platform alliances, it will then be able to influence environmental evolution by a focused development and deployment of its resources. The course of development of both alliance portfolios underscores that firms prefer to implement shaping strategies if their resource strength enables them to do so. By observing the development of both alliance portfolios, one can see, as formulated in Proposition 8, that companies switch from exploring to exploiting newly built resources when strategic uncertainty declines. The built-up stock of resources needs to be commercialized consistently and efficiently to earn back the high investments in resource development.

The ideal course of development of alliance strategies, as formulated in Proposition 9.1, can be easily observed in the way Siemens developed its alliance portfolio for rail and transportation systems: At the beginning of this development, Siemens implemented isolated probing and platform alliances. With expanding resource strength

and diminishing strategic uncertainty, alliance linkage strength and coordination intensity between alliances increased and dispersion of alliances decreased. Individual alliances (minority equity stakes) to improve mechanical capability were successively linked to utilize economies of scale, causing the gradual disappearance of structural holes between partners that were present at the beginning of the development process. In the last years of the studied period, Siemens decided to completely acquire these firms and integrate their resources into the core organization so they could be replicated and exploited more efficiently. The development of the alliance portfolio for fossil energy production is also in accordance with Proposition 9.1: Siemens turned successful learning alliances into core alliances that were tightly coordinated, then either terminated or redefined them once the technology-related uncertainty had diminished.

Both case studies illustrate impressively how the configuration of the alliance portfolio depends on what alliance strategy has been implemented. When alliance strategy moved from adapting to shaping and stabilizing (ideal developmental path), the number and dispersion of the alliances initially established decreased, and the linkage intensity of the alliances increased in line with Proposition 9.1 (see Appendix). This development pattern can be traced to the fact that strategic uncertainty decreases and the resource endowment of the focal business unit improves as the business matures. As already mentioned, the only deviation from the proposed development patterns occurred with respect to the redundancy of the alliances in the change to a stabilizing strategy. According to Propositions 6 and 9.1, the contextual overlap of the exploitation alliances should be high because most of the alliance partners are from the same cluster of the interorganizational field and because, in mature industries, the interorganizational field is more tightly linked than in emerging industries. But our data show that the redundancy remained about the same when the alliance strategy changed from shaping to stabilizing. The reason is that Siemens—for efficiency reasons—had established only a small number of exploitation alliances.

Thus we have to refine the proposed theoretical framework: when portfolio strategies change from shaping to stabilizing, the redundancy of the alliance portfolio will increase only if several exploitation alliances are established to leverage

the resource base of the focal business unit. In addition, the number of alliances, as well as their dispersion and redundancy, may be affected by the implementation of a hybrid strategy. If, for example, the stabilizing strategy is complemented by an adapting strategy, then—according to our propositions—the dispersion of the whole alliance portfolio will be higher and the redundancy will be lower than in a pure stabilizing strategy.

Notwithstanding, both case studies mostly confirm the proposed course of development of alliance portfolio. As the company's resource endowment improves and strategic uncertainty diminishes, the alliance strategy slowly evolves from an adapting to a shaping strategy and then to a stabilizing strategy. All alliances studied developed, without exception, along the predicted developmental path, i.e. from probing alliances to core exploration alliances (or were set up as core exploration alliances from the outset) and later were terminated or transformed to exploitation alliances.

In both businesses, Siemens did not withdraw to a pure exploitation strategy. It complemented this main strategic direction using new exploration alliances in environmental sectors with increasing exogenous uncertainty. This is why both analyzed alliance portfolios turned to hybrid strategies and again increased the number and dispersion of alliances. This development pattern illustrates that companies do react—as assumed in Proposition 9.2—by implementing exploration strategies when there are new entrepreneurial chances and risks. According to Proposition 10, these exploration strategies can complement exploitation strategies to assure a balanced development and deployment of the resource endowment of the focal business unit, thus balancing the trade-off between short-term profit maximization and long-term viability of a business. Pursuing different alliance strategies on the market side and on the technology side is obviously a common way of combining alliances with different strategic orientations.

The longitudinal study impressively shows how company and industry development coevolve. In both fields, Siemens, pursuing the described alliance strategies, was able to achieve a fundamental improvement of its competitive position in industries that were consolidating quickly. At the same time, the financial performance of Siemens improved significantly in both businesses, showing that Siemens was also able to turn the improved

resource endowment into better financial performance.¹⁷

CONCLUSION

This study confirms the importance of the relational view of strategic management (Dyer and Singh, 1998; Gulati *et al.*, 2000). The findings show how companies can systematically access resources outside their entity boundaries with alliance strategies and how doing so helps to strategically optimize the position of the focal company in the interorganizational field and to improve its financial performance. Such insights can contribute to further elaboration of the theoretical bridges between the resource-based view and network approaches.

The longitudinal case studies illustrate typical developmental paths and patterns in the evolution of alliance portfolios. The development course of alliance portfolios comprises three stages, evolving from adapting to shaping and exploiting (stabilizing), according to the state of strategic uncertainty and the firm's resource endowment. If there is an increase in exogenous strategic uncertainty, the alliance strategy can also revert from the exploitation stage to an exploration stage, either leading to a complete reorientation of alliance strategy or to a hybrid strategy. This means the developmental course we have identified is not a fixed path—i.e., a one-way street from adapting to exploiting. Instead, the development of alliance portfolios is contingent on external constraints and opportunities (changes in exogenous uncertainty), internal resources available, and strategic choices that interact and drive the pace, pattern, and direction of the evolution of a firm's alliance portfolio. This coevolutionary model of alliance development links particular environmental and internal conditions to specific strategic actions—i.e., changes in portfolio strategy. Strategic maneuvers of other companies in the interorganizational field with which the focal company is linked, directly or indirectly, comprise a fundamental external influence factor on how the focal company's alliance portfolio evolves. The concrete developmental course of an alliance portfolio

¹⁷ Of course, the improvement of the financial performance of Siemens in the two businesses studied was also influenced by factors other than the alliance strategy, e.g., by an increase in the operational effectiveness of core processes.

results from the context-specific sequence of development cycles ('episodes') produced by the identified three strategy types and their combinations. This evolutionary model allows much more latitude for choice and chance than traditional deterministic life-cycle models (Aldrich, 1999).

The findings of our study contribute to the ongoing debate on whether companies should mainly try to build stable trust relationships with their partners (generating Coleman rents), or whether they should continuously 'optimize' their interorganizational relationships in an opportunistic way (generating Burt rents). The case study results indicate that, in any alliance, preserving the quality of the relationship (trust) and realizing one's own strategic interests both play a role. Which aspect is more important in a specific case depends on what alliance strategy the company is following in this business. In core exploration and exploitation alliances, stability and commitment are more important than they are in probing alliances.

Our findings also contribute to current network research by illustrating that, to actively pursue an innovation (shaping) strategy, firms need to have strong ties to trustworthy partners and a rather dense network of (partly redundant) cooperative relationships. This insight is contrary to the traditional view, which sees weak ties (Granovetter, 1985) and sparse networks (Burt, 1992) as enablers of effective exploration. It does, however, confirm recent evidence presented by Ahuja (2000b) that innovation success is negatively influenced by structural holes between network partners, and evidence by Hagedoorn and Duysters (2002) that strong ties support effective interorganizational learning and have a positive effect on technological performance. Our study shows that contradictions in the evidence can be resolved by differentiating between active and reactive modes of exploration (shaping and adapting). Actively focused exploration often means acquiring implicit knowledge from trustworthy partners and therefore requires high intensity and intimacy of exchange between alliance partners along with safeguarding the quality and reliability of obtained information and resources—hence strong and partly redundant ties. On the other hand, reactive adaptation (general increase of strategic flexibility) necessitates flexible access to as many information sources and resources as possible. Reliability and quality of accessible resources are initially not so important here—hence the weak and non-redundant ties.

Limitations

A fundamental limitation of the study comes from the small number of cases. Therefore our empirical findings can only illustrate the proposed theoretical relationships and developmental patterns and not provide a robust empirical test. The propositions presented need to be tested with a large number of cases using appropriate statistical methods. But the disadvantage of having analyzed only two cases is reduced by understanding that case studies do not aim at statistical generalization but at analytic generalization. Analytic generalization means that a previously developed theory is used as a template with which to compare the empirical findings of the case studies. If the cases are shown to support the theoretical framework, replication may be claimed (Yin 1994: 31). In principle, analytic generalization can be used whether the case study involves one or several cases. But, of course, the more cases analyzed, the higher the external validity of the findings. Our findings, from studying only two (related) cases, should be generalized only with great caution. In any case, the findings can be applied only to large companies and not to start-up firms. Current empirical studies (Rothaermel and Deeds, 2004), for example, show that start-ups have to rely more strongly on alliances to exploit existing strategic resources than do larger, more established companies (incumbents) because they lack complementary assets.

Another limitation on the validity and reliability of the empirical findings stems from the simple operationalization and measurement of the configuration parameters.

Further research

The above-mentioned deficits in our study offer a promising starting point for additional research. Future studies could investigate whether the paths and patterns of alliance portfolio evolution that we have identified can also be found in other industries and how alliance strategies by start-ups and small and medium-sized companies differ from those of larger incumbent firms. Future alliance research should particularly take into account the fact that individual alliances increasingly are embedded in a tight network of interorganizational relationships, meaning that more attention needs to be given to aspects of multi-alliance management. From the perspective of strategic management,

the impact of interorganizational relationships on the performance of a focal company is of central importance. In this regard, an analysis of the interdependencies between value creation in networks and value appropriation by members of the network would be an important research endeavor. Another interesting research question would be to investigate how firms measure the performance of their total alliance portfolio and how performance measurement influences the development of portfolio strategies.

When the performance consequences of interorganizational networking are analyzed from the perspective of a firm, however, appropriate consideration must be given to the interaction between the strategic maneuvers of the focal company and those of its network partners. For example, one could study how a focal company coordinates the strategic plans for its alliance portfolio with the alliance strategies of its partner(s) and overcomes any possible conflicts.

From a methodological perspective, the findings of our study underscore that the coevolutionary framework is helpful when studying the interplay between intra- and interorganizational development processes. In this respect, alliances that represent institutionalized linkages between firms and their environments can be considered an especially attractive object of inquiry. Empirical alliance research needs to emphasize longitudinal studies, especially multiple case studies. Our findings clearly show how important sequence and order are for an in-depth understanding of interorganizational relationships.

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APPENDIX
Development of the alliance portfolio of the fossil energy production business

Year	Alliance strategy	Changes of alliance portfolio	Configuration parameters			Business performance	
			Number	Dispersion	Redundancy	Linkage strength	Financial
1990							Below average
1991							0.4
1992							
1993	Adaptation: learning alliances to develop new gas turbine	Establishment of contractual alliance 'steelstar'					
1994	s.a.	Establishment of contractual alliance 'turbinepower'					
1995	s.a.	Establishment of joint venture 'blade coating'; establishment of contractual alliance 'thermostar'	4	3	1	1	Average 0.625
1996	Shaping technology + explore new markets (hybrid strategy)	Tighter coordination of established technology alliances; establishment of contractual alliance 'gearstar'; establishment of joint ventures in China and India	7	3	Technology alliances: 2 Marketing alliances: 1	Technology alliances: 2 Marketing alliances: 1	Average 0.7
1997	s.a.	Acquisition of 'steelstar'					
1998	s.a.	Termination of 'turbinepower'					
1999	Exploiting technology (stabilizing) + explore new markets	Redefinition of 'thermostar' from a learning alliance to a long-term outsourcing contract of maintenance; enlargement of scope of 'gearstar' alliance	5 (3 of which are new and 1 is redefined)	Technology alliances: 1 Marketing alliances: 2	Technology alliances: 1 Marketing alliances: 1	Technology alliances: 3 Marketing alliances: 2	Above average 0.85

Development of the alliance portfolio of the rail and transport systems business

Year	Alliance strategy	Changes of alliance portfolio	Configuration parameters				Business performance	
			Number	Dispersion	Redundancy	Linkage strength	Financial	Market share
1990							Below average	0.2
1991	Adaptation: development of mechanical competence to become full-service provider	Minority equity stake in Duewag						
1992	s.a.							
1993	Development of mechanical competence + stabilizing customer-relationship with GM for U.S. market	Establishment of contractual customer/supplier alliance with GM						
1994	s.a.	Minority equity stake in Krauss-Maffei	3	3	1	1	Below average	0.7
1995	Shaping strategy to build up mechanic competence and to develop ICE business further + stabilizing U.S. market	Tighter coordination of all alliances related to the development of mechanic competence; establishment of ICE3 consortium on contractual basis	4	3	2	2	Below average	0.76
1996	s.a. + exploring new markets + exploring new technologies	Acquisition of 50% stake in Matra; establishment of joint venture with CTS; establishment of joint venture with Toshiba; establishment of Eurotrain consortium						

(Continued)

(Continued)

Year	Alliance strategy	Changes of alliance portfolio	Configuration parameters			Business performance	
			Number	Dispersion	Redundancy	Linkage strength	Financial
1997 s.a.	Establishment of joint venture with Ansaldo						Market share
1998	Consolidating the alliance portfolio: integrating and exploiting mechanical competence + terminating unsuccessful marketing alliances	Acquisition of majority stakes in Duewag and Matra; termination of Toshiba joint venture	5 (3 of which are new)		Technology alliances: 2 Marketing alliances: 2	Technology alliances: 1 (3) ^a Marketing alliances: 2	0.86
1999	Exploiting full service-provider competence (stabilizing) + stabilizing mature markets and explore emerging markets and new technologies	Acquisition of majority stake in Krauss-Maffei; tight integration of all now fully owned subsidiaries to realize synergies			Technology alliances: 2 Marketing alliances: 3	Technology alliances: 2 (3) ^a Marketing alliances: 3	Average

^a Including the acquired alliances with Duewag, Krauss-Maffei, and Matra.