Why do Complementors Participate? An Empirical Analysis of the Emergence of Partnership Networks in the Enterprise Application Software Industry

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ABSTRACT

The enterprise application software industry is currently undergoing profound changes. The well-established, large providers (hubs) are fostering partner networks with small complementors (spokes). This paper takes the perspective of these spokes and seeks to understand their motivations for partnering. Drawing on research on dynamic capabilities and complementarity, an explanatory model of the spokes' motivation to partner is developed. It is argued that partnering is especially attractive for smaller organizations when it enables them to access the hub's complementary commercial, technological, and social capital. The model is empirically examined through a post hoc analysis of 17 small enterprises.

The study reveals that the hub's reputation as part of its social capital as well as its commercial capital indeed act as reasons to participate in partnership networks. In contrast, the hub's technological capabilities may be seen as a double-edged sword. While the hub's capability to provide integrated systems was found to be a prime reason for partnering, its innovative capability may actually detain spokes from partnering. The negative influence of the hub's innovativeness, however, was found to be contingent upon the type of solutions offered by hub and spoke. The same holds true for the positive effect of the hub's commercial capital.

Keywords: Enterprise Application Software Industry, Small and Medium Sized Enterprises, Partnership Networks, Complementarity, Dynamic Capabilities, Service-Oriented Architectures

INTRODUCTION

The organizational structure of the enterprise application software (EAS) industry has been undergoing significant changes during the last decades. EAS provide functionality for supporting various business processes as well as the respective infrastructure and middleware systems. In the early days of computing, these systems were mostly custom-developed in a make-to-order fashion. In the 1970s, standardized, monolithic systems that covered the majority of the business processes of a variety of customers emerged and became the state-of-the-art during the 1980s (Mertens, 2005). The emergence of these systems turned the formerly diverse industry into an oligopolistic structure with a few dominating system vendors producing best practice solutions for different industries (Campbell-Kelly, 2003; Davenport, 1998).

In recent years, however, this trend has been countervailed by a tendency towards disintegration (Bresnahan & Greenstein, 1999; Messerschmitt & Szyperski, 2003). Facilitated by the emergence of standards and infrastructure technologies, like for example service-oriented architectures (SOA), the formerly integrated systems are more and more characterized by a high degree of modularity (Fan et al., 2000; Baldwin & Clark, 1997; Schilling, 2000). From a theoretical point of view, it can be argued that the tendency towards disintegrated systems should be reflected by a higher degree of organizational modularity (Conway, 1968; Hoetker, 2006). However, in spite of the increasing inter-organizational division of labour in the EAS industry, a seamless coordination between different organizations and friction-free mixing and matching of software components from different vendors is still a vision. Instead, stable partnership networks have emerged in which companies of the EAS industry cooperate based on mutual agreements (Gao & Iyer, 2008). Within these partnership networks, a limited number of large organizations, often referred to as hubs, platform leaders or keystones (Jarillo, 1988; Iansiti & Levien, 2004), provide the systems' architecture as well as generic core functionalities, while smaller software companies

(referred to as spokes or niche players) build their solutions upon and complement these platforms (Prencipe, 2003; Iansiti & Levien, 2004; Teng, 2003). These partnership networks may be described as loosely-coupled systems (Orton & Weick, 1990) where the participants are not linked by capital (for example joint ventures) or through joint effort in a specific project or business area (strategic alliance), but by more general agreements usually based on certifications of the other party's products or resources (Sanders & Boivie, 2004; Vitharana, 2003).

In IS research, cooperative arrangements in the EAS industry have recently been studied more intensely. It has been argued that mergers and acquisitions (Gao & Iyer, 2006) as well as strategic alliances (Gao & Iyer, 2008) are formed in order to create value from complementarities that exist between different parts of the overall software and service architecture. In the context of hub-and-spoke partnership networks, previous studies focused on the hub organization and argued that hubs benefit from partnering with a multitude of smaller complementors due to the existence of two-sided network effects (Rochet & Tirole, 2003). The software platform of a central vendor becomes more valuable if more complementary products exist, possibly turning the system of the winner in this system competition into a *de facto* standard (Shapiro & Varian, 1999). Thus, the attractiveness of taking on the role of this central actor increases with the growth of the network (Morris & Ferguson, 1993).

In contrast to previous literature, this study aims at answering the question why small spoke organizations participate in hub-and-spoke networks. The ability of small spoke organizations to benefit directly from network participation through externalities is limited. Thus, it has to be assumed that the key benefits originate from the dyadic relationship with the hub. Therefore, in order to understand the underlying rationale for the spokes to participate in a partnership with a hub organization, it is essential to understand the unique resources and capabilities that the hub brings into the network. From a theoretical perspective, in answering

this question, this paper contributes to previous research on technological complementarities between organizations in the EAS development industry. Moreover, this study adds to previous research on inter-organizational division of labour and inter-firm complementarity of capabilities and resources by applying and adapting existing theories to the special case of hub-and-spoke networks in the EAS industry.

Drawing on the concept of complementarity and on a resource-based perspective on inter-organizational arrangements, three types of capabilities of hub organizations are identified that are proposed to act as key rationales for smaller companies to become a partner of a large systems provider (Ahuja, 2000). The proposed reasons are combined in a theoretical framework and empirically examined in a multiple case-study design which focuses on two particular partnership networks.

THEORETICAL FOUNDATION

Access to Complementary Capabilities as Motives for Partnering

Previous research has predominantly drawn on the resource-based view of the firm (RBV) for understanding why organizations participate in cooperative relationships (Ireland et al., 2002; Das & Teng, 2000). By viewing firms as bundles of resources, it has been argued that the main reason why firms partner is to gain access to resources which they currently do not possess, but which the partner is offering (Eisenhardt & Schoonhoven, 1996). Stated in other words, organizations form partnerships in order to access external resources which are *complementary*, that is, which are dissimilar from and compatible to their own ones (Das & Teng, 2000). In particular, firms are assumed to strive for complementary *dynamic capabilities*. Dynamic capabilities refer to the ability of using resources in a way that enables organizations to not only react to changes in their environment but to shape their environment to a certain extent (Teece et al., 1997). This ability is particularly relevant in dynamic contexts, such as EAS development (Miles et al., 2005).

The following section discusses dynamic capabilities that hub organizations possess and spokes lack. These complementary capabilities are assumed to be the key motivating factors for the partnership formation from the spokes' perspective. They are developed referring to three general types of capabilities identified in the literature: technological capital, commercial capital, and social capital (Ahuja, 2000). The proposed model that explains why spoke organizations participate in partnerships with hubs is illustrated in Figure 1. Each of the particular propositions (P) will be theoretically deduced subsequently.

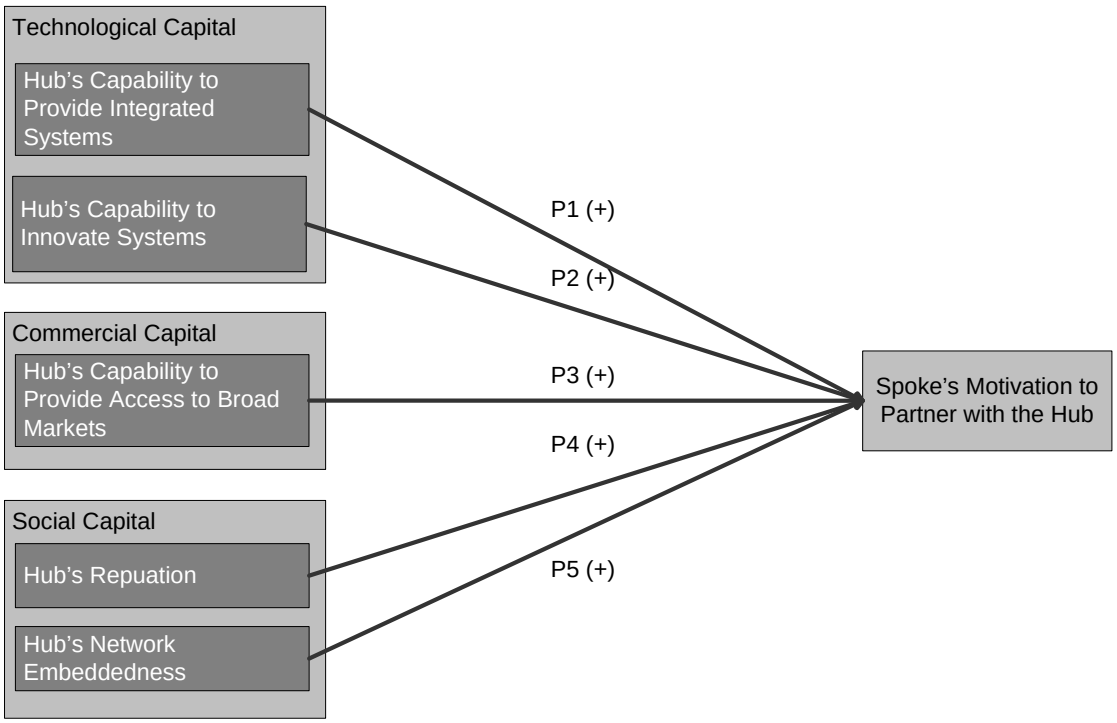

Figure 1: Model for Explaining the Partnering Motives for Small Companies in the EAS Industry

Technological Capital

Spokes may partner with hub organizations in order to get access to their technological capital. Based on the findings of Hagedoorn (1993), the hubs' capability to provide integrated systems and to innovate these systems may be distinguished.

Hub's Capability to Provide Integrated Systems. The EAS offered by small vendors is usually dedicated to a very specific fraction of the customer's business processes. Therefore, spoke organizations depend on the availability of a complementary system that covers the core functionalities of an EAS. The capabilities to provide such comprehensive systems are exactly the core competency of hub organizations, historically rooted in the mentioned swing of the pendulum towards systems consolidation (Campbell-Kelly, 2003). These capability to provide integrated systems stems from a profound understanding of various underlying technological disciplines and their interrelations, an understanding of the entire system behaviour in terms of relevant parameters, the ability to design the entire system, the ability to design most key components of the system, and the ability to assemble component interfaces (Prencipe, 2003). As an example, the capabilities to provide such an integrated system served as the foundation of the success story of large providers of enterprise resource planning (ERP), that were the first to enable a seamless integration of the entire information flows within an organization (Davenport, 1998).

Today, the systems landscapes of customer organizations are largely dominated by these solutions of incumbent EAS vendors (Mertens, 2005). Therefore, the spokes' business critically depends on the inter-operability of their own solution with that of the large systems providers (Mertens, 2005). In order to achieve this inter-operability, small companies need an in-depth knowledge about the functionalities and interfaces of these systems. By partnering with a large system provider, the small vendors can facilitate their access to this knowledge.

Proposition 1: Small software producers (spokes) are partnering with large EAS producers (hubs) in order to gain access to their capabilities to provide an integrated system.

Hub's Capability to Innovate Systems. The capabilities to provide an integrated system refer to the exploitation of the potential of an existing system, which has been defined by the hub organization. This rather short term oriented "synchronic" capability differs from the long term capability to introduce incrementally or radically new systems which has been referred to

as “diachronic” systems integration capabilities (Prencipe, 2003). While innovativeness clearly constitutes one of the key dynamic capabilities of small software firms (Mathiassen & Vainio, 2007), it is less clear how a small company benefits from the innovativeness of a large partner. More clarity is achieved through classifying innovations into different categories.

As such, for industries that are characterized by a modular mode of operation, innovation at the component and at the system level can be distinguished (Henderson & Clark, 1990). While component innovations accrue within the boundaries of a module, system innovations are affecting the general structure by which the components are bound together to form a coherent system. A prominent and recent example for such an innovation at the system level can be seen in the emergence of new system architectures, like for example SOA.

System innovations require the capability to understand interdependencies between the different components as well as the functionality of the entire system (Henderson & Clark, 1990). Stated in other words, these system innovations are not confined to the narrowly circumscribed components in which the small companies specialize. Thus, it can be assumed that small vendors face difficulties in developing innovations on the systemic level. In contrast, in order to stay competitive in the systems competition with rival vendors, hub organizations have to continuously innovate the overall system. It is important to stress that not only particular innovative products or services that are suggested to turn firms into attractive partners, but the capability to constantly invent new products and services and to bring them to market (Teece et al., 1997). Spokes do not necessarily use the hub’s products, but aim at providing a module of a comprehensive and innovative system that fulfils and will fulfil the changing customer requirements. This can be achieved through partnering with hub organizations.

Proposition 2: Small software producers (spokes) are partnering with large IS producers (hubs) in order to gain access to their capabilities to develop system innovations.

Commercial Capital

Commercial capital can be defined as an organization's "manufacturing and marketing capabilities, and assets such as manufacturing facilities and service and distribution networks" (Ahuja, 2000, p. 320). Transferred to the case of the EAS development industry, manufacturing assets and capabilities are of minor importance, since once developed, the marginal cost for producing additional entities of the software product, for example by copying data on DVDs, is close to zero (Shapiro & Varian, 1999, p. 20ff). This is reinforced by the emergence of new deployment models like software as a service (SaaS), where marginal costs are zero and only distribution costs exist. Consequently, the following discussion will focus on the hubs' marketing capabilities and service and distribution networks.

Hub's Capability to Provide Access to Broad Markets. Since they will mostly be unable to make large investments into marketing activities and distribution networks, small and innovative start-up companies may critically depend on external marketing and distribution capabilities. Partnering with a global player may provide the opportunity to make the spokes' innovative products available for a great number of potential customers (Hagedoorn, 1993; Ahuja, 2000; Eisenhardt & Schoonhoven, 1996). Thus, through a partnership arrangement, spoke organizations may benefit from the sophisticated marketing and distribution capabilities of large providers (Rao & Klein, 1994). The scope of the hub organization's marketing support may range from a simple communication of the partnerships or recommendation of the partner and its solutions to a joint and comprehensive market addressing. One specific example of external marketing support that has been discussed in the literature is the international market entry of small software companies, where partnerships with established firms were found to be of great importance (Coviello & Munro, 1997; Moen et al., 2004; Mohr & Spekman, 1994).

Closely related to this discussion is the aspect that spoke organizations may benefit from their partnership with a hub organization that defines technologies, markets, strategies, structures, and processes (Gawer & Cusumano, 2002) in that they may gain access to market-related information that would otherwise be impossible to obtain. For instance, hub personnel may "warn" the spoke in advance if its solution becomes obsolete (for example, because it becomes part of the hub's system) and thereby provide the spoke with more time to bring in its capability to innovate on a modular level and to come up with new solutions and functionalities. Moreover, hub staff may actively provide the spoke with hints which market segments are promising and will not be addressed by the hub in the future (Uzzi, 1997, p. 45).

Proposition 3: Small software producers (spokes) are partnering with large EAS producers (hubs) in order to gain access to their capabilities to address broad markets.

Social Capital

Social capital provides "both information and reputation benefits to well-connected firms" (Ahuja, 2000, p. 312). More specifically, the hub's social capital may result in advantages for its smaller partners in two different ways. First, the spokes may benefit from partnering with the hub through tapping into the hub's popular brand name and high-profile in the market. Second, the hub's partner network of spoke organizations may allow a particular spoke to get access to peer organizations for further inter-organizational collaboration.

Hub's Reputation. Small and recently founded companies often face the challenge that they are unknown in the market and that customers are doubtful about the quality and reliability of their products and services. Signalling trustworthiness is of special importance in the EAS industry, since the quality of software and the knowledge and experience of business processes is difficult to assess in advance (Akerlof, 1970; Vitharana, 2003). The market reputation of large systems providers may help small vendors to overcome this problem. Through a partnership with a large vendor and an official accreditation of the spokes' resources or products by the hub organization, small companies can increase the level of trust

in their solutions and their sustainability (Sanders & Boivie, 2004; Vitharana, 2003). Mentioning the partnership with the famous brand name of the globally acting hub organization may increase and improve the customers' perception of the small spoke companies.

Proposition 4: Small software producers (spokes) are partnering with large EAS producers (hubs) in order to gain access to their social capital in terms of high reputation in the market.

Hub's Network Embeddedness. As discussed above, large hub organizations foster partnership networks with a multitude of smaller complementors in order to become a *de facto* standard. Thus, being embedded in a network of spoke companies and disposing of extensive network resources (Gulati, 1999) is a direct competitive advantage for hub organizations (Yli-Renko et al., 2001) (Ahuja refers to these direct advantages as the "substantive role of social capital" (Ahuja, 2000)). Although spokes have no direct advantage from winning the system competition with competing platforms, they can be assumed to eventually be better off being in a successful partnership network that becomes the *de facto* standard (Rochet & Tirole, 2003). Moreover, small companies may benefit from the hub's embeddedness in a network of spokes in that it may provide them with further opportunities for formal and informal collaboration that would otherwise be out of reach (Ahuja, 2000). For instance, employees of two spoke companies that do not cooperate on a formal basis may know each other from events organized by the hub and therefore may decide to establish a formal partnership or recommend each other on an informal basis.

Proposition 5: Small software producers (spokes) are partnering with large EAS producers (hubs) in order to gain access to their social capital.

EMPIRICAL ANALYSIS

Methodology and Data Collection

This research takes a multiple-case study approach (Kerlinger & Lee, 2000). The paper deals with the question *why* small companies are partnering with well established large system providers. The case study approach is particularly promising to answer such *why* questions about motivations and rationales (Yin, 2003). The context in which case study research is especially well suited is characterized by two distinctive features. First, the boundaries between the studied phenomenon and its context are blurred. Second and closely related to this, a multitude of both variables of interest and available data covering these variables exist. Both features are clearly given in the above described context of EAS development. Obviously, various stakeholders and influencing factors are involved in this industry, and it is by no means clear which belong to the studied phenomenon and which are context.

Since this study is concerned with the motives of small companies for partnering, the *unit of analysis* is the particular organization. In order to enable the comparability of the individual cases and at the same time control for peculiarities of single networks, the focus is set on two particular partnership networks which were established by two hub organizations. This approach allows to investigate partnership formation by considering the contextual conditions of different organizations and, thereby, allows for an analytical generalization of the study findings (Yin, 2003). More specifically, generalization is achieved by applying literal replication logic while keeping in mind the purposeful choice of two different partnership networks. Thereby, each case is treated as a separate study for examining the proposed relationships (Yin, 2003). It is important to stress that the goal of this study is to answer the question why firms participate in partnerships with hub organizations and not to explain variations in the motivation of small companies to partner. This is done through an ex post analysis of firms that actually have entered into these partnerships, that is, through applying

literal replication. Since all analyzed spoke companies decided to form a partnership with the respective hub, the motivation to partner can be assumed to be high in all cases.

Figure 2 shows a stack model of an information system comprising five layers (compare Bresnahan & Greenstein, 1999). While in the context of this study, EAS can be assumed to reside mainly on the infrastructure and application layer, the two analyzed hub organizations historically focus on different core businesses. One hub organization (Hub A) has its traditional core competency on delivering business process application solutions and, therefore, has had its main activity on the application layer (Figure 2). Although this is still the case today, the recent version of hub A's EAS is based on SOA technology rather than on a standardized, monolithic system. Thus, while still having its core competency on business process applications, today hub A occupies both the application and the infrastructure layer. Contrary, the second hub analyzed in this study (Hub B) historically covered the whole information systems stack as depicted in Figure 2. During the 1990s, however, hub B made the strategic decision not to offer business process applications anymore and instead clearly focus on infrastructure and middleware solutions.

The two hub companies are both large, globally acting EAS vendors that have fostered partnerships with a multitude of smaller independent software vendors that build their solutions upon the hub organizations' platform and reside on the business process application as well as on the infrastructure and middleware layers. In many cases, these smaller partners offer additional customizing and consulting services. Out of this vast network of spoke organizations, 17 companies were selected that participate in a partnership with one of the two hubs, eight of them with hub A and nine with hub B. The cases were selected purposefully (Quinn Patton, 2002) in order to ensure that each of the 17 case companies represents an independent legal entity and is not a subsidiary of a larger organization.

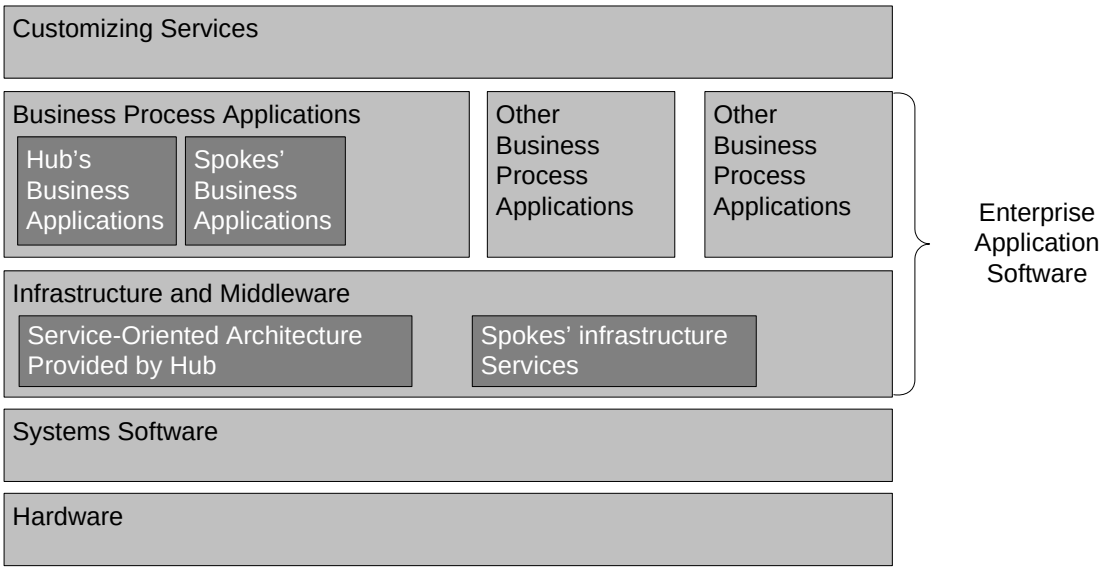

Figure 2: Stack Model of Enterprise Application Software (based on Grove, 1996).

Data was collected through on-site expert interviews with executives or employees involved in the partnership management. The data collection occurred between May 2007 and July 2008. The expert interviews were guided by the propositions presented above. In total, 22 interviews were conducted within the 17 spoke organizations. On average, the interviews lasted one hour and resulted in a transcript of more than 80,000 words of qualitative data. All analyzed companies build their solutions upon the hubs' platform and, thereby, extend the overall system in a certain way. Each of the spoke organizations is a certified partner of the respective hub. Table 1 introduces the case companies and their core business as well as the number of expert interviews conducted at each site.

Case Company	Core Business	Number of Interviews
A1	Integration between the hub's system and various machines such as vending machines or intelligent refrigerators	2
A2	Integration between the hub's system and a CAD system of a different vendor	1
A3	Integration between the hub's system and a groupware system of a different vendor	1
A4	Providing systems for automatic, mobile data recording, used for example for inventory management	1
A5	Full-range supplier of IT systems and services for newspaper publishing companies	3
A6	Integration between the hub's system and various archiving systems	2
A7	Integration between the hub's system and various enterprise output systems, such as high-volume printers	1
A8	Providing a product information management system for cross-media publishing	2
B1	Development of groupware and e-procurement solutions based on the hub's platform	1
B2	Provision of groupware components and workflow applications based on the hub's platform, especially for the financial services industry	1
B3	Provision of document and email archiving, IT security, and groupware solutions based on the hub's platform	1
B4	Development of applications based on the hub's groupware system, for example CRM, project and knowledge management systems	1
B5	Development of enterprise application software based on the hub's middleware	1
B6	Providing a decision support system for credit approval processes in the financial services industry based on the hub's groupware system	1
B7	Providing solutions for archiving, groupware, CRM and portals through combining own components with the hub's platform	1
B8	Providing applications for content management, enterprise portals, groupware, and ERP systems based on the hub's infrastructure solutions	1
B9	Providing e-business, groupware, and portals solutions based on the hub's middleware	1
17	Total	22

Table 1: The Analyzed Case Companies

For data analysis purpose, codes were developed for the five discussed propositions (Miles & Huberman, 1994) by assigning a brief label to each of them: *Innovation*, *Technology*,

Market, *Reputation*, and *Embeddedness*. Using this scheme, the transcripts of the interviews were then coded by assigning text passages to the five partnership motives proposed in the theoretical framework. This process resulted in a table of 175 text passages. The extracted interview fragments were then used for a two-stage analysis. First, a rough estimation of the importance of each of the proposed benefits was assessed by counting the frequencies of the relevant fragments and their estimated influence (Miles & Huberman, 1994). Bearing in mind the qualitative nature of this study, this quantitative analysis aims at obtaining a first approximation to the results of the case studies. Throughout the coding process, it became obvious that a scale from irrelevant to highly positive influence was not sufficient to capture the diversity of the statements. Instead, some of the factors that were proposed to increase the spokes' motivation to partner actually had a negative impact in some cases (see data analysis section for details and interpretations). Therefore, a scale reaching from -2 (highly negative influence) over 0 (neutral) to 2 (highly positive influence) was used for coding purposes. Second, the underlying background of each fragment was carefully considered in the light of each proposition. In the following, the findings from this two-stage process will be presented.

Results

Table 2 provides an overview of the average number of relevant interview fragments per interview for each of the proposed partnership motives. Moreover, the table shows the average influence of the respective factors on the spokes' motivation to partner with the hub as indicated by these fragments, quantified by means of the scale presented above. As such, the hub's capability to provide integrated systems (*Technology*) was the most frequently mentioned motive for participating in the partnership network (3.4 times per interview). Also, the average influence of this capability as indicated by the interview fragments is considerably high (1.3). Although mentioned less than two times per interview, the hub's reputation (*Reputation*) is suggested to be an important motive. The 1.8 mentions of the hub's reputation

indicated an average influence of 1.6, the highest score of all codes. The hub's capability to access broad markets (*Markets*) was ranked second both with respect to the average number of quotes (2.7) as well as the average importance of the respective fragments (1.2).

	Innovation	Technology	Market	Reputation	Embedded-ness
Total Number of Quotes (∑ 175)	31	58	46	30	10
Average Number of Quotes per Interview	**1.8**	**3.4**	**2.7**	**1.8**	0.6
Indicated influence of respective factors (-2 to 2)	-0.1	**1.3**	**1.2**	**1.6**	0.8

Table 2: Quantitative Analysis of Interview Fragments

The picture is different for the hub's capability to innovate systems (*Innovation*) and the hub's embeddedness in a network of organizations (*Embeddedness*). While the hub's capability to innovate systems on average was mentioned almost two times per interview (1.8), the influence of the hub's innovative capability on the spoke organization's motivation to partner with the hub seems to be close to zero and even negative (-0.1). The hub's embeddedness in a network of organizations was found to be the least often mentioned factor (0.6) and also had the second lowest importance as suggested by the respective quotes (0.8). Subsequently, this first rather quantitative approximation will be complemented by an in-depth, qualitative analysis of the case studies that will be substantiated by exemplary quotes from the interviews, beginning with those propositions that found the strongest support in the quantitative approximation.

Hub's Capability to Provide Integrated Systems (Proposition 1). In accordance with the theoretical discussion and the suggestions from the quantitative analysis of the relevant interview fragments, a qualitative analysis of the case studies supports the proposition that

getting access to the hub's capability to provide integrated systems is an important reason for spoke organizations to participate in partnerships with the hub. In all spoke cases, the interviewees unanimously declared that the spokes partner with the hub in order to build their systems upon the technological platform provided by the hub organization.

"The hub provides infrastructure systems like for example data bases. This is an area where we build on the hub's system but do not develop solutions ourselves" (Spoke B7).

"We realized that the customers have the requirements to combine systems for computer-aided design with the hub's platform, and that's what we do" (Spoke A2).

"We are focused on the hub's platform. We can only exist in system landscapes where the hub's platform is running" (Spoke A5).

"Our solution rounds up the hub's solution portfolio by providing complementary functionality" (Spoke A4).

As suggested in the theoretical discussion, the spoke organizations do not only strive for getting access to the hub's technological capital in the form of complementing the hub's platform, but also aim at absorbing the hub's knowledge about the system as well as information on how to integrate the own module with the overall system.

"The greatest benefit resulting from the partnership is the access to technology and know-how" (Spoke B9).

Interestingly, this knowledge transfer does not seem to be part of the official partnership arrangement. Instead, spoke organizations seem to mainly rely on informal contacts to hub personnel in order to get access to valuable information.

„Trainings are not part of our partnership with the hub; you can book them like anybody else could. Sometimes we work together on an informal basis. We say to hub personnel: 'We have a problem, do you have any ideas?'" (Spoke A1).

"We have a lot of contact with the labs in the U.S. After all, we live on information" (Spoke B7).

"There is this partner forum, where partners can discuss technical issues among each other and also with developers from the hub organizations. This is very valuable for us" (Spoke B2).

Taken together, the hub's capability to provide integrated systems indeed seems to be one of the primary reasons for small EAS companies to partner with large, well-established players. Thus, proposition 2 is substantiated by the empirical analysis.

Hub's Capability to Provide Access to Broad Markets (Proposition 3). The quantitative approximation suggests that the hub's capability to provide access to broad markets is an important reason for spoke organizations to participate in a partnership with a hub. An in-depth analysis of the conducted case studies largely confirms this picture. Indeed, all interviewees mentioned the fact that small software companies struggle to market their products without the support of a large and well-established partner.

"Ideally, through a partnership with an established player, a company obtains a very good market access through using the channel of the large organization. That's a very important aspect" (Spoke A8).

"The strategic reason for partnering was to participate in the market presence of the hub and thereby generate growth" (Spoke A2).

"An important aspect of the partnership is to get orders and appear in the hub's solution catalogue, that is, to draw attention to the offered solutions" (Spoke B1).

"We wanted to get this software partnership because without it, we wouldn't have a lot of market success with our products" (Spoke A3).

In addition to these marketing advantages that are part of the formal partnership agreement, the benefits resulting from partnering with a hub organization lie in a rather informal recommendation of the spokes' products by the hub's sales personnel.

"The colleagues at the hub organization say to their customers: 'There is a solution from [A6], have a look at it and buy it if you need it'" (Spoke A6).

"In the best case, the hub sales staff says to the customer: 'If you need a product management system, you should choose the one from [A8]. That's a great solution, and it is certified'" (Spokes A8).

The in-depth analysis of the case studies largely confirms the suggestion that small software vendors would have difficulties to enter international markets without the help of their larger partner because they do not dispose of the necessary commercial capital.

"One important aspect is that together with the hub, we try to find new customers on a global scale, like for example in the U.S. and in Southeast Asia" (Spoke A3).

"The essence of the partnership with the hub organization is that the hub markets our solutions as one of its own modules on a global scale. It is on the hub's price list." (Spoke A2).

Interestingly, some spoke organizations had high expectations regarding the access to the hub's marketing capabilities that were not fulfilled.

"Our expectations concerning marketing advantages might have been too high" (Spoke B4).

While this last point will be dealt with throughout the remainder of this paper, it can be concluded that the hub's capability to access broad and international markets generally can be assumed to play an important role when it comes to the reason why small EAS vendors participate in hub-and-spoke partnership networks, thus substantiating proposition 3.

Hub's Reputation (Proposition 4). While the quantitative approach to analyze the empirical data already suggests that the hubs' reputation plays a role when it comes to the spokes' partnering motives, this impression founds ample support when analyzing the case studies in detail. The following interview fragments exemplify the unanimous support for this proposition.

"Yes, of course, an important reason for partnering is the image improvement" (Spoke B4).

"The hub organization is a very famous company; [A3] wants to benefit from this popularity" (Spoke A3)

"A very important aspect is that with such a partnership and the respective recommendations of an established player, [A8] could gain credibility and reliability" (Spoke A8).

"The hub organization fits very well because of its established name" (Spoke B9).

"The strategic goal of the partnership was to improve our image" (Spoke B5).

"To be a partner of the hub is a commendation for us. Even though the customers do not know the exact meaning, it still increases the trust in us" (Spoke B3).

"The partnership is beneficial because of the reputational effects. Small companies have to present themselves and the hub's label is positive. It signals reliability and seriousness" (Spoke B8).

Thus, the case studies provide support for the theoretical assertion that spokes try to benefit from communicating the partnership with the hub to the customers and thereby signalling reliability and credibility. Thus, proposition 4 is supported by the case studies. Interestingly, this seems to be of special importance if the customer organizations of the spokes are themselves small companies.

"Especially when having small and medium sized customers, partnering with the hub organization is a great advantage because our company is not so popular. In contrast, everybody knows the hub organization" (Spoke B3).

Hub's Embeddedness in a Network of Organizations (Proposition 5). The qualitative analysis of the interview transcripts found that some interviewees indeed mention the hub organization's embeddedness in a network of organizations as a motive for participating in partnerships.

"Through the partnership with the hub we have met other partner firms that use and recommend our products" (Spoke A2).

"There are collaborations with other firms in the hub's partner network. People know each other from other projects" (Spoke A1).

However, the spoke organizations that mentioned the hub's embeddedness in a network of organizations collaborate with other spokes on a very infrequent basis.

"We don't work together with other firms in the partner network on a regular basis. Sometimes people know each other from conferences or trade fairs. Sometimes we recommend these firms to customers and they do the same. But this is purely based on informal contacts" (Spoke A6).

"From time to time, we work together with other partners in the network. However, we are very careful since these firms are always our competitors at the same time" (Spoke B3).

Thus, although knowing peers from other spoke organizations might turn out to be helpful for the employees of a focal spoke from time to time, it does not seem to be one of the prime motives to partner with larger hub firms. Hence, both the quantitative and the qualitative analysis of the case studies do not support the proposed relationship between the hubs' network embeddedness and the spokes' motivation to participate in partnerships with these hubs, thus contradicting proposition 5.

Hub's Capability to Innovate Systems (Proposition 2). The quantitative analysis of the relevant interview fragments provided mixed results for proposition 2. While the hub's capability to innovate systems was mentioned relatively often, the average influence of this capability on the spokes' motivation to partner was close to zero. When analyzing the case studies in more detail, it became apparent that some spoke organizations indeed seem to partner with the hub in order to get access to its capability to innovate overall systems.

Specifically, as suggested in the theoretical discussion, SOA is mentioned as an example for an architectural innovation.

"The hub organization is innovative and this is something that we need" (Spoke B9).

"The emergence of service-oriented architectures opens the proprietary systems of the large ERP vendors. This allows small and medium sized partner firms to become a system supplier for bigger and integrated solutions" (Spoke A7).

"SOA will have an influence. We have to reflect how we can port our software on these service-oriented architectures. First, this porting will result in expenses, but hopefully also in advantages later on" (Spoke A4).

However, the innovativeness of the hub organization may also be perceived to be negative for the spokes, as the following quote from an interview partner at Spoke B1 suggests.

"One problem with the hub organization is that there are always a lot of new concepts and ideas, so that it is hard to keep an overview and to know which goals the hub organization pursues" (Spoke B1).

Even more important, the hub's innovativeness seems to be not beneficial at all for some spoke organizations. As such, in some cases, the hub's innovative capability was found to actually endanger the spokes' business model. The reason for this may be seen in the fact that through innovating the overall platform, the spokes' complementary solutions, which often address certain deficiencies of the hubs' systems, may turn out to be obsolete.

"As a partner of the hub organization, it can happen that within a few years, the architecture changes and the hub adds the provided functionality to its own solution" (Spoke A2).

"It happened that some functionalities of our products became part of the hub's solution. We struggled explaining the added value of our products to our customers" (Spoke A2).

"We develop interfaces between the hub's system and a solution for computer-aided design. One risk for us is that the two organizations decide to form a partnership and integrate their systems themselves" (Spoke A2).

"One risk is that the hub organization has to include certain functionalities into its platform that are also part of our solution. In our case of data archiving, this happened several times in the past. Some customers were saturated with the functionalities of the hub's platform and didn't need additional software" (Spoke A6).

Thus, while the theoretical discussion suggested that the spokes partner with a hub in order to benefit from its innovativeness, the empirical analysis reveals that the hub's capability to innovate systems may actually detain spoke organizations to partner with a certain hub. Even though there seem to be some companies that partner with the hub because of its capability to provide systems innovations, the overall findings suggest a revised version of proposition 2 that reverses the proposed effect.

Proposition 2_{rev}: The systems innovation capabilities of a large system developer (hub) are detaining small software companies (spokes) from partnering with this hub.

Summing up, the data analysis revealed mixed support for the propositions. In particular, with regard to the benefits from the hub's capabilities to innovate systems, there are strong differences between the spoke organizations. In order to explain this interesting and ambiguous observation, the next section sheds more light on the characteristics of the analyzed spoke organizations.

Layer Overlapping in the Software Stack

When analyzing the profiles of the spoke companies as presented in Table 1 as well as the stack model in Figure 2 in more detail, it becomes apparent that some spoke organizations provide infrastructure solutions, while others focus on business process applications.

Comparing the spokes' and the hubs' positioning within the layers of the EAS stack, it can be observed that the solutions of some spokes overlap to a greater extent with the core business of the respective hub than others. The third column of Table 3 provides an overview of the layer overlapping with the respective hub organization. For example, spoke A8 provides a product information management system within the system landscape of hub A, which itself strongly focuses on providing business process applications. Thus, layer overlapping in the EAS stack between spoke A8 and hub A can be assumed to be high (see Table 3). In contrast, B5 develops enterprise application software based on the hub B's middleware. As outlined above, hub B clearly focuses on infrastructure solutions. Thus, the layer overlapping between spoke B5 and hub B can be assumed to be rather low.

Table 3 compares the spokes' attitude toward the hubs' capability to innovate architectures (reaching from negative ("-") over indifferent ("0") to positive ("+")) with the degree of layer overlapping between hub and spoke. Analyzing Table 3 reveals that for those spoke organizations that exhibit no layer overlapping with the respective hub, the position toward the hub's innovativeness tends to be positive or indifferent. In contrast, when the layer overlapping increases, the spoke organizations consider the hubs' innovative capabilities as being rather harmful. One exception of this tendency is spoke A8, which has a high overlapping in the software stack with the solutions provided by the hub, but still rates the hub's innovativeness as being beneficial.

Case Company	Spokes' Attitude toward hub's innovativeness	Layer Overlapping in the EAS stack
A1	0	Medium
A2	−	Medium
A3	−	Medium
A4	−	High
A5	−	High
A6	0	Medium
A7	0	Medium
A8	+	High
B1	+	Low
B2	0	Medium
B3	0	Medium
B4	+	Low
B5	0	Low
B6	0	Low
B7	+	Low
B8	0	Low
B9	0	Low

Table 3: Spokes' Position toward Hub's Innovativeness and Estimated Layer Overlapping

Interestingly, however, spoke A8 faces another threat that is very similar to the hub's innovativeness from a theoretical point of view and that may have the same consequence of technological obsolescence.

"The hub organization has acquired a company in the U.S. which, among others, offers a product that covers our niche. Thus, the hub has its own solution at hand and cannot just throw it away. Currently, the market does not really understand the situation, because in some aspects, we are partnering with the hub, while in others, we are competing. Without doubt, this makes it very difficult to build up a real strategic partnership with joint marketing" (Spoke A8).

In order to substantiate or discard the impression of a decreasing appreciation of the hub's innovativeness with increasing layer overlapping, Table 4 provides the respective figures from the quantitative data analysis in an aggregated manner. It shows the average number of quotes

per interview and the indicated influence of those factors that have been confirmed in the previous analysis (Innovation, Technology, Market, and Reputation), clustered according to the degree of layer overlapping (Low, Medium, High). This quantitative analysis provides support for the observation that the negative influence of the hub's capability to innovate systems as articulated in the revised proposition 2 is stronger for those spokes that provide solutions that reside on the same layer as the core functionalities provided by the respective hub. As such, the influence of the hub's innovativeness indicated by the respective interview fragments is even positive (0.6) for those spokes that show low layer overlapping. On the contrary, the negative impact of the hub's innovative capabilities becomes prevalent with an increasing degree of layer overlapping. From a theoretical point of view, this seems reasonable because in case of high layer overlapping, the threat that the hub's innovations may indeed render the spokes solutions obsolete and thereby jeopardize the spoke's business model can be assumed to be much higher. Stated in other words, the advantage of being part of a network with an innovative platform is outweighed by the threat that systems innovations on part of the hub may, in an extreme case, make the spoke's solution useless.

	Average Number of Quotes per Interview			Indicated influence of respective factors (-2 to 2)		
Degree of Layer Overlapping	Low	Medium	High	Low	Medium	High
Innovation	1.1	3.0	2.3	**0.6**	**-0.5**	**-0.6**
Technology	4.0	2.4	3.3	1.2	1.5	1.6
Market	**2.2**	**3.0**	**3.7**	**0.8**	**1.3**	**1.6**
Reputation	2.0	1.4	1.7	1.6	1.6	1.6

Table 4: Quantitative Analysis of Clustered Interview Fragments

These findings clearly suggest that the overlapping between the spokes' and the hubs' solutions moderates the degree to which the hubs' capability to innovate systems detains spoke organizations from partnering with this hub. If the overlapping is low, the effect that has

been articulated in the revised proposition 2 is rather low or even reversed. Contrary, if the layer overlapping is high, the revised proposition 2 is reinforced. Proposition 6 summarizes these findings.

Proposition 6: The higher the layer overlapping in the EAS stack between the solutions offered by hub and spoke, the stronger is the proposed negative effect of the hub's systems innovation capability on the spoke's motivation to participate in a partnership with this hub.

When further analyzing Table 4, another interesting observation can be made. The figures suggest that the hubs' capability to address broad markets, which generally has been found to be a motive for spokes to participate in partner networks with large EAS providers, may be contingent upon the type of solution provided by hub and spoke as well. As such, the marketing benefits for small partners are suggested to be especially high if the layer overlapping between the partners is high, that is, if hub and spoke to some extent reside on the same layer of the EAS stack. Table 4 shows that with an increase in the layer overlapping between hub and spoke from low over medium to high, an increase both regarding the average number of quotes per interview that deal with the hub's commercial capital (2.2, 3.0, 3.7) as well as the indicated influence of the hub's marketing capabilities (0.8,1.3,1.6) can be observed.

An in-depth analysis of the case studies largely confirms this assertion. As outlined above, for spoke B4, the hub's commercial capital indeed was a prime reason to participate in hub B's partner network. However, B4 remained rather unsatisfied with the hub's marketing support. Other spokes that had an equally low layer overlapping anticipated that the hub's capability to address broad markets would not be very beneficial to them and therefore did not mention the hub's commercial capital among the primary partnering motives. Thus, it can be argued that the layer overlapping between hub and spoke acts as a moderator of the proposed positive effect of the hubs' commercial capital on the spokes' motivation to partner with this hub.

Proposition 7: The higher the layer overlapping in the EAS stack between the solutions offered by hub and spoke, the stronger is the proposed positive effect of the hub's capability to address broad markets on the spoke's motivation to participate in a partnership with this hub.

Summarizing the above discussion, Figure 3 shows the revised theoretical framework that explains why small organizations participate in partnership networks with larger, well-established EAS companies.

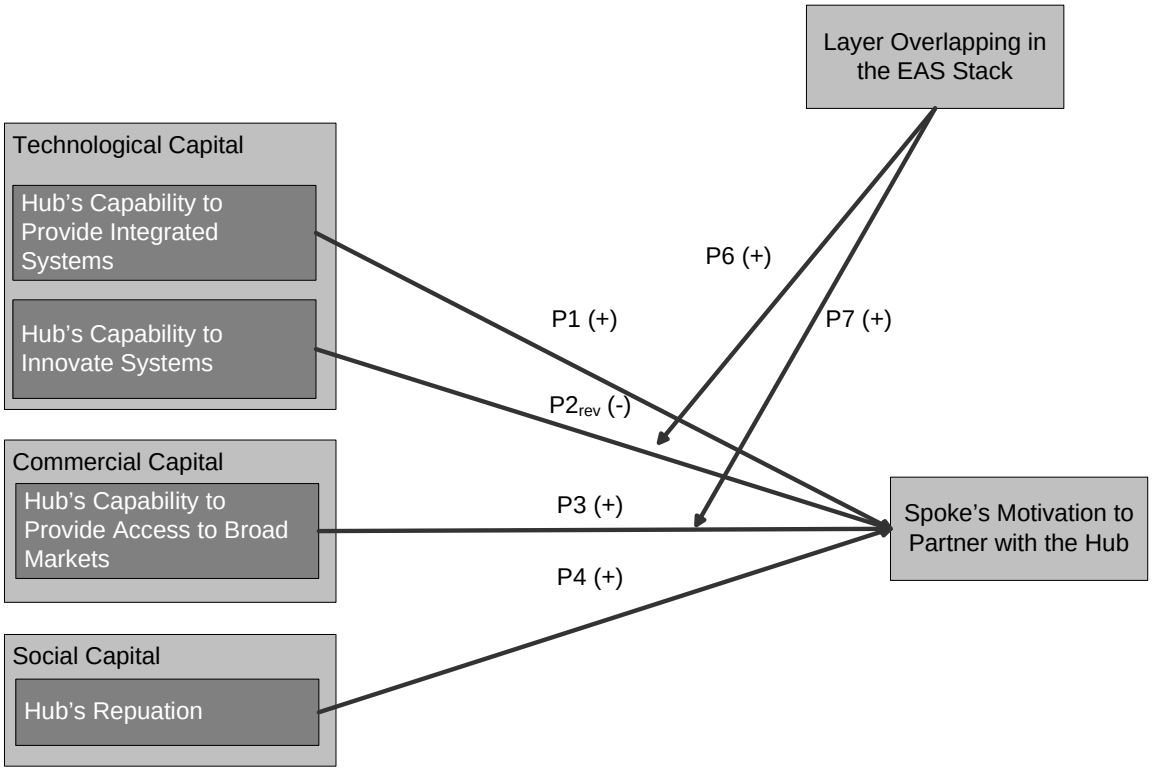

Figure 3: The Enhanced Model for Explaining the Motives of Small Companies to Partner

DISCUSSION AND CONCLUSION

This paper has addressed the emergence of novel organizational structures in the EAS development industry. It builds on recent work that has examined the role of complementarities for explaining inter-organizational forms of cooperation in the software industry (Gao & Iyer, 2006), as well as on previous findings of dynamic capabilities that small

companies need in order to stay competitive in the software market (Mathiassen & Vainio, 2007). The study is unique in that it focuses on new, more loosely-coupled forms of hub-and-spoke partnership arrangements that have emerged in the EAS industry.

Theoretical Implications. This study contributes to the literature on partnership formation by studying its determinants in the context of the EAS industry. While previous research argued that an organization's technological, commercial, and social capital turns it into an attractive collaborator (Ahuja, 2000), this study found that in the case of hub-and-spoke networks within the EAS industry, the hub's technological capital may both be a blessing and a curse for its partners. Therefore, this study suggests that a high-level approach to understand partnering motives through classifying dynamic capabilities into technological, commercial, and social capital may not be sufficient. Instead, subdividing dynamic capabilities into more fine-grained categories seems to be more appropriate.

Through identifying the influence of the partnering companies' positioning within a software stack model, this study contributes to the literature on the interdependence between technological complementarity and inter-organizational division of labour (Das & Teng, 2000). Previous research argued that the success of inter-firm arrangements depends on the firms' complementarity within the software stack (Gao & Iyer, 2006; Gao & Iyer, 2008). This study has transferred the software stack model to the question why small firms participate in partnerships in the first place. In contrast to Gao and Iyer's findings, the results of this study revealed that the influence of layer overlapping in the EAS stack model on the small company's decision to partner with a certain hub is ambiguous. On the one hand, higher layer overlapping increases the expected benefit resulting from the access to the partner's commercial capital. On the other hand, however, it also increases the threat of the hub's capability to innovate systems. This insight has wider implications for the general discussion on the interdependence between technological and organizational modularity (Conway, 1968; Hoetker, 2006). Technological modularity can be assumed to be high if there is no

overlapping within the software stack. Indeed, the decreased threat of opportunism may give small EAS vendors an incentive to participate in partnership networks, that is, in modular organizational structures. However, small EAS vendors may also be restrained from participating in modular partnership networks due to the expectedly low benefit regarding marketing and distribution activities. Thus, the general assertion that a higher degree of technological modularity is necessarily reflected by a higher degree of organizational modularity cannot be upheld within the context of the EAS development industry.

Managerial Implications. The theoretical insights of this study have important managerial implications. First of all, spoke organizations may benefit from the finding that the hub's capabilities are not always beneficial for its partners. Especially, the hub's tendency to innovate systems should be observed carefully in order to avoid that the own solution becomes obsolete. Small organizations should consider these results when reflecting on their role within a partnership network. If a spoke organization considers itself to be highly innovative and is convinced that larger organizations will be unable to provide similarly innovative solutions within the spoke's niche, it may be beneficial to complement a certain hub's system on the same layer in order to benefit from the hub's commercial capital. However, if a spoke's solution has the characteristics of a commodity, it may be more fruitful to complement the system of a hub that mainly acts on adjacent layers, thus benefitting less from the hub's commercial capital but avoiding the risk of obsolescence.

Large and well-established EAS vendors that aim at fostering partnership networks with smaller niche players could also learn from the findings of this study. Knowing which capabilities the spokes aim at when participating in hub-and-spoke networks may help hub organizations to attract partners and manage the partnerships more successfully. Also, in order to foster successful and sustainable partner networks, hub organizations should reflect carefully whether it might be advantageous to explicitly focus on one layer of the EAS stack and leave the adjacent layers to its partners.

Limitations and Future Research. While it should be kept in mind that the results of this research are based on a limited set of data and that the qualitative nature of the analysis may include some form of bias, the findings provide an interesting starting point for further research in the area of partnership networks in the software industry. One fruitful avenue for such an endeavour may be to move away from the rather generic stack model and analyze the technological complementarity between hubs' and spokes' systems in more detail. As such, it may be interesting whether effects similar to the ones identified between layers (that is, layer overlapping) also exist within the layers of the stack. Stated in other words, a more distinct elaboration on the differences between groups of spoke organizations and their implications promises to be especially insightful.

In addition to these extensions of the research model presented in this study, the findings may lay ground for future research that analyzes the management of partnerships between small spoke companies and large hub organizations. As such, this research already hinted upon the fact that small spokes often do not only benefit from the formal partnership arrangements, but also from rather informal coordination mechanisms like, for example, a knowledge transfer between colleagues that is based on good will or a personal recommendation of a valued partner's solutions. Further elaborating on these formal and informal coordination mechanisms may be insightful not only for research, but for practitioners alike.

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