

Management Mechanisms of Network Layers in MNE.

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In recent years the internationalization of industrial R&D has been interpreted as an attempt by technology-intensive companies to exploit location-specific innovation advantages in order to compete in an increasingly globalized environment. Multinational companies are organizing their R&D in the form of integrated networks in order to transfer and adapt knowledge more effectively within their organization. These networks build an additional organizational layer which needs to be managed in order to unfold its full potential. This article illustrates two different management types found within MNE, their variation is based on the differences in corporate structure and culture which lead to different management mechanisms being used. The findings of this article are based on a study of 81 technology-based multinational companies that was undertaken between 1994 and 2002, and followed by an in-depth study of network management mechanisms conducted on 230 networks in 2002-2004.

Keywords: Open Innovation; Innovation Networks, Management Mechanism, Network Layers

Introduction

In recent years the internationalization of industrial R&D has been interpreted as an attempt by technology-intensive companies to exploit location-specific innovation advantages in order to compete in an increasingly globalized environment. While it is true that technology-based companies' knowledge creation processes have become increasingly global, they nonetheless remain limited to a relatively small number of countries. Technology-based companies strive to locate their R&D activities at centers of excellence, i.e., regions characterized by a high rate of new technology output. This trend is further intensified by a scarcity of resources in these companies' home countries. Networks are one promising coordination mechanism with which to transfer knowledge from foreign R&D laboratories to the main organization, and thus increase internationalization's value for a multinational enterprises (MNE).

Networks enhance knowledge sharing and innovation within and across companies therefore they are an increasing phenomenon in a knowledge-driven society, (Tsai & Ghoshal, 1998, Kilduff & Tsai, 2003; Tsai, 2001; Inkpen & Tsang, 2005; Ritter & Gemünden, 2003). Whereas most recent literature focuses on inter-firm networks' structure, outcomes and variables linked to competitive success (Bae & Gargiulo 2004; Baum, Calabrese & Silverman, 2000, Dyer & Nobeoka, 2000; Gupta & Govindarajan, 2000; Nishiguchi, 1994) as well as networks' evolution (Venkantraman & Chi-Hyon, 2004; Soda, Usai & Zaheer, 2004), hardly any literature investigates formal inter-unit networks and their influence on corporate success. Some recent literature does point out the positive effects of informal inter-unit networks, e.g., unit leaders' network ties with peers and higher-level managers positively influencing unit performance (Mehra et al., 2003); units with denser networks achieving a higher level of productivity (Reagans & Zuckerman, 2001), and high-performance work teams having moderately cohesive

ties internally, or many bridging ties to formal leaders in other groups (Oh, Chung & Labianca, 2004). Reagan, Zuckerman and McEvily (2004) ascertained that organizational units with high internal density and a large external range finish projects more quickly; similarly, Krackhardt and Stern (1988) illustrate that friendship ties across groups provide coordination in response to crises. However, management mechanisms with which to enhance the full potential of networks for knowledge sharing and creation within multinational enterprises are not as yet sufficiently acknowledged in theory. With the empirical results presented in this paper we hope to add to this discussion.

Research Methodology and Data Sample

Our study of 81 technology-based companies that was undertaken between 1994 and 2002 shows that a small home market and few R&D resources in the home country, as in the case of ABB, Novartis and Hoffmann-La Roche (Switzerland), Philips (Netherlands) and Ericsson (Sweden), are the main drivers for companies to relocate their R&D abroad. By the end of 1980s, more than 50% of Swiss, Dutch and Belgian companies were indeed conducting their R&D outside their home country - indicative of an increasing trend to conduct R&D in foreign research laboratories (see Pearce & Singh, 1991; Granstrand et al., 1993, p. 414, and Gassmann, 1997, p. 53). Companies such as General Electric and General Motors in the USA, Toyota and Fujitsu in Japan, and DaimlerChrysler in Germany that have large home markets and a substantial domestic R&D base, are under less pressure to internationalize their R&D activities (part of the results are published in Gassmann & von Zedwitz, 1999 and von Zedwitz & Gassmann, 2002). We analyzed R&D's organizational structure within multinational companies. A main result was that successful companies organize their R&D in integrated networks in order

to transfer knowledge effectively from foreign research laboratories to the organization.

Based on this result, we conducted an in-depth study integrated R&D networks' management mechanisms by investigating 230 networks in a comparative case study from 2002-2003. We subsequently identified network structures' core components. By investigating the management of network layers in four knowledge-intensive companies, we then deduced the management mechanisms used to transfer technological knowledge effectively and to support cooperate goals. The results are described in this article.

Management mechanisms of R&D network layers

R&D as integrated Network

On examining the distribution of R&D sites worldwide (figure 1), it becomes obvious that R&D units are concentrated in five regions. The investigated 1,021 R&D locations of a total of 81 technology-intensive companies show that there is a strong R&D concentration in the Triad regions of Europe (particularly Germany), the US (northeastern USA and California), Japan as well as, increasingly, in major regional centers of South Korea, Singapore, and other emerging economies of the Pacific Rim. Although research is more concentrated than development, and the main regional centers for development largely coincide with regional centers for research, development is more evenly distributed (the results are published in von Zedwitz & Gassmann, 2002, p. 573-575).

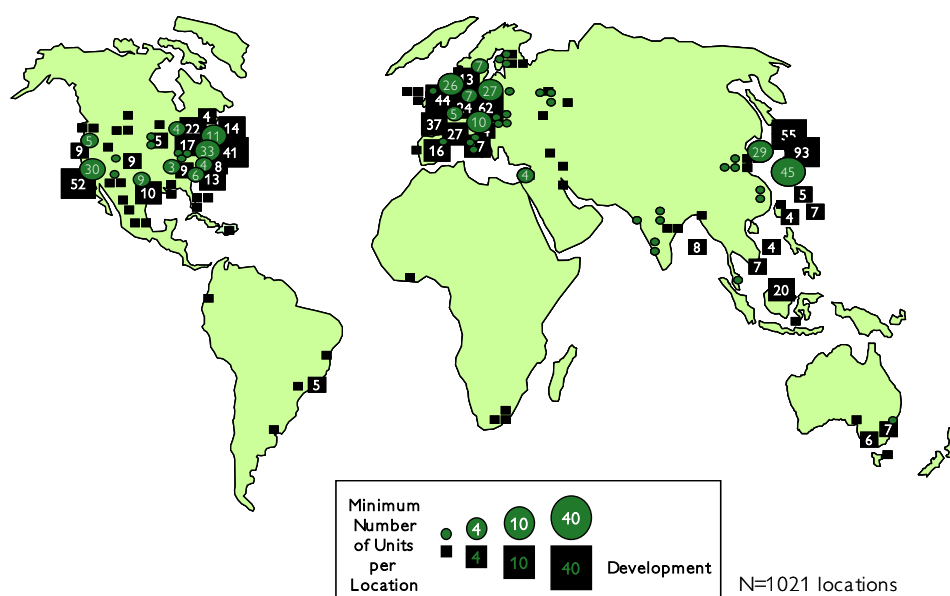


Figure 1: Worldwide Dispersion of R&D Sites (Source: von Zedtwitz/Gassmann, 2002, p. 574) The decision on where to establish new R&D units takes R&D-specific factors such as the quality of input at the new site (through the tapping of local talent, engaging in local scientific collaboration etc.), the quality of the expected output (cooperation with local customers and local development, market proximity etc.) and this R&D unit's general efficiency (critical mass, project hand-over, cost issues etc.) into consideration. The decision is also affected by R&D-external factors such as tax optimization, the local political and social system's reliability and stability, and image enhancement (see von Zedwitz and Gassmann, 2002, p. 575). Based on these findings, two principal drivers for R&D internationalization can be identified: the quest for external science and technology, and the quest for new markets and new products. More specifically, these drivers comprise: access to knowledge and technology resources, learning from leading markets and adaptation to demanding customers. To summarize: the main potentials are seen in interaction and learning along the value chain rather than in cost savings. Obviously the integration of knowledge as well as its creation is a main factor in the undertaking's success or

failure. The organization of interaction between the R&D sites as well as with the home base should support this knowledge transfer and creation.

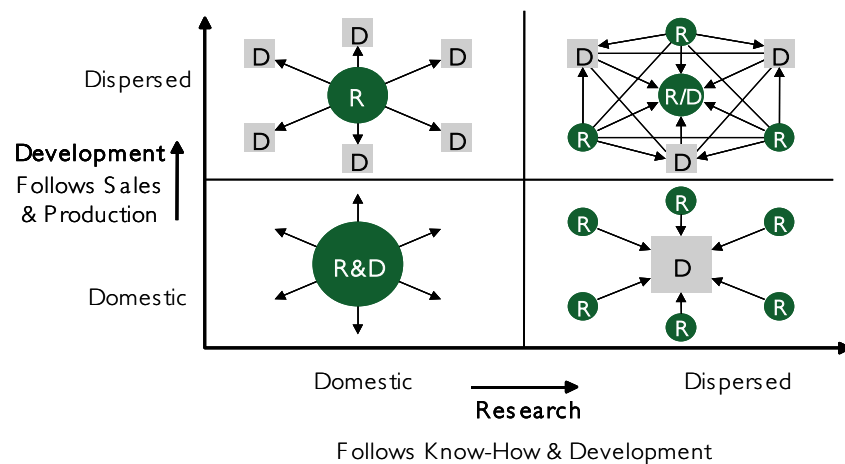


Figure 2: Four Archetypes of international R+D (Source: von Zedtwitz/Gassmann, 2002, p. 575)

In the study, four archetypes of R&D internationalization as well as a major trend towards a networked organization were identified. From a more domestic (centralized), organized research and development, called a ‘national treasure’, the R&D processes’ increased orientation towards markets and centers of knowledge has led to a geocentric approach with more dispersed research, but with domestic development (‘technology-driven’) still occurring. Both archetypes developed their structure over time through the establishment of listening posts. The first development is always towards a Hub Model and then, through the empowerment of foreign R&D, towards ‘global R&D’ with an integrated network of dispersed research and development. Polycentric R&D structures emerge where ‘market-driven R&D’ results in domestic research and dispersed development. The trend shows an integration of decentralized R&D locations into an integrated network structure as well. New findings indicate a trend towards re-centralization to tighten

coordination (von Zedwitz and Gassmann, 2002). From a company perspective, these dispersed structures naturally require strong coordination mechanisms to ensure knowledge sharing and creation between the units and the home base.

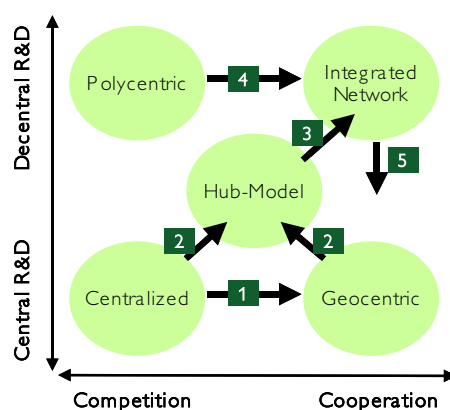


Figure 3: Five Trends in international R&D (Source: Gassmann/von Zedtwitz, 1999, p. 245)

Components of network layers

Network structures have immense inherent potential in respects of the integration of multiple entities (whether globally dispersed or not) and can support knowledge sharing and creation through their environment (e.g., Hansen, 2002; Birkenshaw et al., 2002 and Birkenshaw, 2002). Intra-organizational (or inter-unit) networks can be used to connect experts in formal communities in order to share knowledge across the company's geographical, hierarchical and functional boundaries. Organizational forms of knowledge sharing should support the line organization's work. The power structure between those organizational forms and the line, in general meaning the degree of decision-making power that each has, is in the region of a 20:80 ratio. Companies experienced in knowledge management attempt to create a more flexible

organization by shifting the power structure towards the organizational forms. This creates a powerful and flexible company that is able to react swiftly to innovations and market change. One can therefore hypothesize that the more an organization shifts its power towards supplementary organizational forms, the more the company develops itself into a flexible network organization. Networks can thus help facilitate this transition.

In investigating network management, a variety of variables may be selected for study (Gilsing, 2003; Wissema, 1991). Whereas size (Pyka, 1990; Staber, 2000; Swan 1999), boundaries (Prange, 1999; Krebs & Rock, 1997), density and integration (Gemünden & Heybreck, 1997; Ritter & Gemünden, 1998; Koschatzky, 2000), transparency (Hamel, 1991), centrality (Valenta, 1995; Siebert, 1999; Weber 1997), entry or exit (Duschek, 1998; Staber, 2000), composition (Steward, 2000), stability (Sydow, 1992), kind of transfer (Herschel, 2001; Köhne, 2004; Sydow & van Well, 1999), flexibility (Gomez, 1995; Fusco, 2003), hierarchy (Goh, 2002; Koschatzky, 2000), symmetry (Van Aken, 2000; Moverly, 1996), spatial range (Koschatzky & Sternberg, 2000; Oerlemans, 2001) and redundancy (Pitaway, 2004; Härmäläinen & Schienstok 2001; Prange, 1999) are structural elements of networks, the industry itself has an influence on network management. Authors have consequently recognized some industry elements, like industry structure (Marceau, 1999; Sydow, 1999b; Pitaway, 2004), production forms (Lambooy, 2004), technological maturity (Robertson, 1994), and industrial or professional associations (Pitaway, 2004; Swan, 1999) as important influencing factors on networks' activity and management.

Also the transfer process within the network itself can influence a network structure and outcome. Elements like the tacitness or explicitness of the knowledge shared (Sydow & van Well, 1999), network knowledge (Duschek, 1998), formality of content (Härmäläinen, 2001; Pitaway, 2004; Pyka, 2002), intensity, such as frequency of contact (Echeverri, 1999; Hage,

200), the network relationships' durability (Echeverri, 1999), outcome in terms of radical or incremental innovation (Lambooy, 2004; Oerlemans, 1998) and complexity of innovation (Oerlemans, 2001, Sydow & van Well 1999) are important factors too. Because of roles' structural influence and their support of networks' outcomes, they have been widely discussed in network research. Gatekeepers (Hamel, 1989), radial individuals (Valente, 1995), company-spanning individual (Van Aken, 2000), or organizational experts (Zündorf, 1997) and relationship promoters (Walter & Gemünden 2000, Müller, 2004) are just some of roles found.

All the above variables have been conceptualized, but very little empirical evidence has been presented of their importance for network management and their outcomes. Even harder to operationalize are what is termed the "soft facts", like network members or management's intention and motivation (Hamel, 1989; Gemünden & Heydebrek, 1997), cultural aspects like trust (Goh, 2002; Ingham, 1998; Wurche, 1997; Loose & Sydow, 1997; Bachmann, 2000; Pitaway, 2004; Harris, 2000), openness (Goh, 2002, von Krogh, 1996), socialization (Gomez, 1995), network culture (Staber, 2000; Ruigrok, 1999), and reciprocity (Powell, 1996; 1990). Only recently has theory recognized cultural diversity as a supporting factor of innovation within networks (Steward, 2000; Lambooy, 2004; Pitaway, 2004) as well as of networks' innovation capacity (Szeto, 2000). On the other hand, the influence of organizations' absorptive capacity and therefore networks' influence on innovation has yet to interest theorists to any significant degree (Cohen & Levinthal, 1990; OECD, 2001; Fusco, 2003; Pyka, 1990).

Although some authors have recognized that the active management of networks is crucial for success (Inkpen, 1998; Ritter & Gemünden, 1998, Kappelhoff, 2000), or point out that companies need to develop network management competence (Harris, 2000), Walter and Gemünden (2000) derive outcome variables to measure network performance and focus on management by objectives (see also Mensch, 1986), and Wissema (1991) as well as Harris

(2000) identify performance factors, only a few concepts are based on actual empirical evidence and provide help for the practice. This article aims to fill part of the identified gap.

By investigating networks in knowledge-intensive companies, it becomes clear that these networks are not isolated structures but are embedded in a web of interconnected networks. The finding of our study illustrate that this web within companies build an additional organizational network layer in order to meet the challenges that corporations are unable to face with their existing hierarchical, functional or process layers (Figure 4).

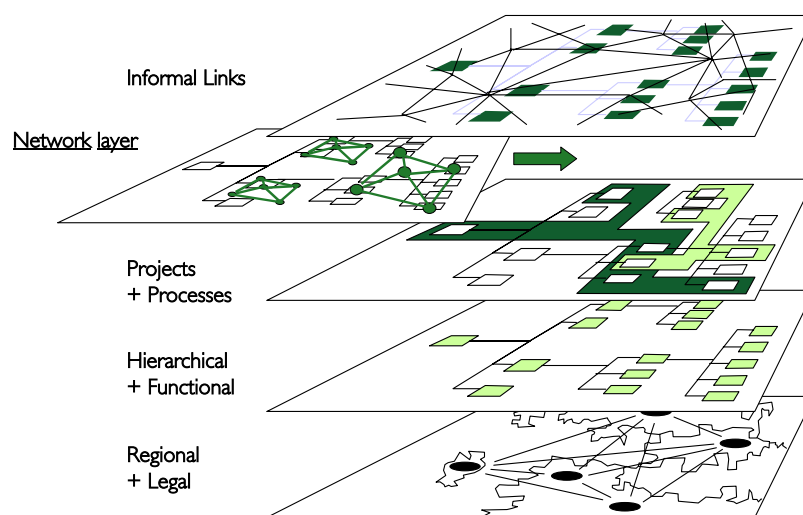


Figure 4: Knowledge-networking systems create an additional organizational layer (adapted from Gassmann & von Zedwitz 1998, p. 154)

What differentiates this network layer from others is that its organizational structure is based on the members' knowledge and not on a hierarchical level, or similarity in people's functions. The networks efficiently connect knowledge owners within the company in order to share their knowledge and create new knowledge, directed by the corporate goals and implemented in the corporate structure. It is a purely knowledge-based structure and might shape the way companies

work in future. In order to work efficiently, those layers need to be managed.

Two different management types of the R&D network layer

Two examples derived from our research illustrate how different these network layers can be and, subsequently, how management approaches might differ.

Autocorp: How can we create a common knowledge base for our car development?

Autocorp is one of the major companies in automotive transport products and services. It has more than 400,000 employees, more than €160 billion in revenue and strategically aims at being a clearly focused and globally acting company, which has made it successful over the past few years. The overall goal of its network system is to link the engineers of the different car platforms to allow them to share lessons learned and to define best practice.

On examining the Autocorp case study, it becomes clear that their knowledge-networking system pursues the *strategic goals* of increasing efficiency and minimizing risk. Engineers from the car development division are linked via knowledge networks to minimize the risk of redundancies and to create synergies in order to increase the internal process's efficiency. Ultimately this reduces costs through quality improvement in the car development division. Another longer term goal was the creation of synergies in development in order to develop components which could be interchangeably used on different car platforms. This would also leverage major cost reduction potentials. However, as long as the various car platforms' individual R&D departments worked independently of one another, or had no strategic need to cooperate, the development of components for use on various platforms was impossible. Simultaneously, there would be no opportunities to formulate common standards and to optimize quality improvement processes. The implementation of a widespread - throughout Autocorp's car development division - and uniform - all sections connected through one system instead of

many - knowledge-networking system was necessary to attain these goals.

This included the forming of a central *knowledge management (KM) team* based in the car development division and empowered, by being directly linked to the overall director of car development, to maintain the networking systems' performance to enable long-term competitive advantage through an efficient knowledge management system. This team thus provides courses for those with various roles within the system, advising and offering consulting services, supporting both meetings and the development of a web-based database that places their work on the intranet as well as enabling collaboration between the frequent meetings. The team also implemented several measures with which to monitor the single networks' performance, but hasn't as yet succeeded in finding an appropriate measurement system.

Because Autocorp is a highly hierarchical company, the knowledge networks' organizational structure within the system is also *hierarchical*, facilitating acceptance of the system as a familiar entity. The various parts of this networking system, similar to the corporate structure, have different functions and responsibilities, such as managing and advising other parts. The common operative and knowledge goals, defined processes adapted from project and internal processes, tasks etc., also smoothed the way to their acceptance.

To achieve the strategic goals, they needed to be translated into feasible operative and knowledge goals for the single networks. They were attained by first creating a mutual knowledge base for all car development. This knowledge base needed to include codified tacit (therefore explicit) engineering knowledge describing best practices and lessons learned as well as standards for all the components and processes required. The creation of this knowledge base was the knowledge networks' main operative goal. The conversion of the engineers' tacit knowledge into explicit knowledge - to enable the transfer of knowledge throughout the car development division - was their main knowledge goal. The *network system's exclusive focus* on

the car development division was necessary and sufficient to achieve the goal, which also focused on this part of the company. To connect all the knowledge owners within the car development division, approximately 100 similarly structured and sized networks were implemented almost unchanged in the last year.

This management type of a network layer is characterized by a strong hierarchical structure and a bureaucratic culture which results in a very structured network systems. The single networks have a low degree of freedom, the clearly defined communication patterns as well as many different functions and roles in order to manage their activities. The strong focus on organizational goals and the implemented centralized control mechanisms by the knowledge management team helps to monitor and optimize performance. All activities within the networks are formal, changes need to be approved by the next higher authorities. On a scale of network management, this network layer is management in a very tight and formal which seem to be appropriate for a very formal and bureaucratic company like Autocorp.

Consumer Corp: How can we support knowledge sharing across product groups?

Consumer Corp is a large international consumer goods company with revenue of more than US\$48 billion, 270,000 employees worldwide and more than 100 brands sold in 88 countries. After a merger, the company was restructured into more independent product groups and regions responsible for their own revenue. This has led to a slightly competitive environment. The downside of the successful reorganization was that the link between regional units working on the same topics, and enriching one another, no longer existed. The company decided to close the structural gap with the implementation of knowledge networks to support knowledge sharing

between the regions and product groups.

Although Consumer Corp has flatter hierarchies than Autocorp, and, unlike ComputerCorp, no strong knowledge culture, its networking system is not very formalized. The network system's global *strategic goals* are to increase efficiency by decreasing redundancies and creating synergies between as well as within the various independent business units and product groups. Basically, the knowledge networks (called communities within Consumer Corp) try to connect experts within the same field in order to support the sharing of implicit knowledge (as a *knowledge goal*).

The single networks' structure is not very formalized, although the *central KM team* has established a few procedures for setting up networks across the company, which is not a focused, but a global approach, but there is no common operative goal that all the networks need to pursue, or explicitly described procedures, working model etc. These communities were a management initiative and their members are responsible for maintaining their networks and trying to create value for the company, the independent business unit and for themselves.

It seems appropriate that a central KM team has been established to implement a global system for the company as a whole, but the business units' strong focus on self-responsibility and freedom means that centrally fostered initiatives have trouble succeeding.

This might be the reason why the network system, though global, only consists of 20 communities that are spread across the company's product groups and regions (there is therefore a high *degree of penetration*) although the company expected a much higher number of networks to have been established at this point in time. Consumer Corp's management regards knowledge management as an important success factor for creating value, but the *less formalized* network system, having no clear and uniform *operative goals*, makes this system difficult to maintain, difficult to measure in terms of success, and returns on investment difficult to achieve in terms of

the active management support provided. Due to the power structure, the communities are not strongly empowered. Each business unit decides independently if it wants to spend time and money on supporting a community, or on reducing its own power by shifting important decisions, or the improvement of a process etc., to the networks. Consequently, network members find it difficult to create value by applying the outcome of their community work within their home business units.

Obviously there is no uniform performance measurement system with which to monitor the networks, or to prove their value to the management, although brief success stories are communicated to demonstrate some of the networks' success. The less formal network approach therefore replicates the *company's culture* of autonomy and self-responsibility as well as its strong business focus, but the power structure resulting from this structure and culture causes difficulties for all centrally supported initiatives.

Compared to the Autocorp case described above ConsumerCorp's management style can be positioned at the other end of the management style scale. The case illustrates a very low degree of structural ties between the networks and their corporate environment. The networks within the networks layer are mainly self-managed as well as very self-responsible in their setting of goals. Nearly no controlling or communication mechanisms were found, no clearly defined common roles or function but self-defined roles to enable the single networks to reach their network goal. The goals set are individually based in the members' purpose to set up the network, no common goals like in the Autocorp example were established. This management style fits very good to the knowledge friendly culture (transfer of knowledge doesn't need to be supported by many tools or management orders within ConsumerCorp) as well as the de-centralist management mechanisms fits to the strong independency and self responsibility of the business units. Whereas the

Autocorp case presents a very formalized management style ConsumerCorp is the opposite with a very informal management style for its network layer.

Conclusion

Both types can be seen as the start and end of a continuum in which different network management types can be subsumed. Both are effective in terms of knowledge transfer from foreign R&D because their main success factor is their adaptiveness to the corporate environment in which they act.

To summarize, the within-case analysis of the network layers has identified several elements (constructs) that characterize each company's knowledge-networking system (or network layer).

These elements are:

- The company's strategic agenda to be supported by the system
- The operative goals that convey the company's strategy to the single networks
- The knowledge goals as a knowledge perspective translation of the strategic goals to the single networks
- The company's culture that provides a general elucidation of the company's handling of knowledge
- The company's structure that explains the adaptation of the systems and how they differ in structure from the company's structure
- The position of the knowledge management team that enables or hinders the network system's implementation and maintenance
- The number of networks, their structure and their penetration within the organization

Although the strategic as well as the network systems' operative goals are quite similar, the

systems differ substantially in respect of their knowledge goals, the systems' structure, size and network penetration within the company. One explanation could be that the systems' link to their environment (corporate culture and structure) strongly influences their structure and size. By formulating and testing propositions based on the literature review described above, it is possible to create the following model of network layers' (networking-systems) building blocks.

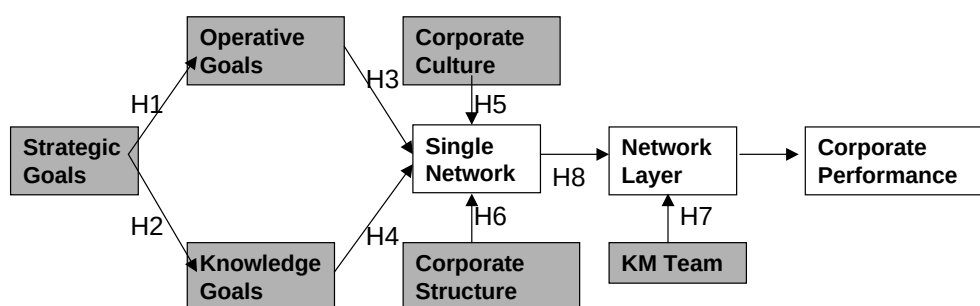


Figure 5: Building blocks of network layers' management within the company

The grew management components and their relation to each other shape the knowledge-networking system (the network layer) and its single networks and thus are crucial for network performance.. The network layers strong linkage to the corporate structure and culture were identified as the most important success factors. The findings also describe how knowledge networks support strategic agendas by translating them into operative and knowledge goals for each single network within the systems. The close link between these goals enables the difficult performance measurement of the networking systems and help to illustrate their impact on the corporate strategic goal. The close link between the goals can therefore be regarded as one of the crucial success factors for management as well. Other building blocks are the adaptation of the network system's shape in respect of the proposed strategic goal (number and shape of the single

networks, degree of penetration) and the corporate structure (e.g., de-centralized or centralized, hierarchical or with flat hierarchies) and culture (e.g., high degree of self-responsibility and the groups' degree of empowerment). The company structure as well as the KM team's locus can be regarded as limitations in choosing a networking system for a company.

These findings have a major impact on management. First, the cases illustrate that an additional organizational network layer enables companies to address strategic agendas with respect to knowledge management. This organizational layer is based on people's knowledge rather than on function or hierarchy. Second, network systems can effectively support strategic goals such as increasing efficiency and innovation or reducing risk. Therefore, knowledge-networking systems provide the link between strategic agendas and knowledge management activities by translating strategic agendas into operative and knowledge goals for the single networks to follow. They provide a substitute micro-environment in which the experts can share their knowledge and provide value for the company and themselves. For the first time, these cases clarify the ways in which the different goals and the company's environment are related to each other and thus illustrate the management components of network layers.

References

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