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Introduction

In the new economy, firms have to produce and distribute products faster to the market and continuously innovate new products to gain a competitive advantage. To extract value from intangible resources and capabilities are becoming increasingly important factors for the competitive advantage of firms (e.g., Drucker, 1988; Prahalad and Hamel, 1990; Quinn et al., 1997; Teece et al., 1997). In addition, it has even been noted that intellectual capital (IC) is a significant source of competitiveness on the national level (Edvinsson & Stenfelt, 1999; Edvinsson, 2002; Bontis, 2003). This has forced companies to form new kinds of structures. One of the new ways of organizing business is network-type cooperation in a regional cluster of small firms.

When successful, networks have numerous advantages for the participating organizations. Networks let the organizations produce more with lower costs by decreasing transaction and capital costs; organizations are able to learn the best practices and obtain market-related information from their partners; and the actors in a region are able to innovate new products in collaboration with others. In the heart of these processes is the capability to create and transfer new knowledge and use the existing knowledge in the network.

We have earlier conducted a framework for modeling and managing IC creation in regional clusters (Pöyhonen & Smedlund, 2004). In this framework, we argued that in order to maximize its value creation potential, a regional cluster of small firms has to create new knowledge, transfer existing knowledge, and implement knowledge at the same time. In this chapter, we will describe this topic in detail, and define a new
approach for understanding regional knowledge creation and the dynamics of creating IC in a complex collaboration of multiple actors.

Three main themes appear in the different theories of the intellectual resources of organizations. These themes are: 1) intangible assets, 2) competencies and capabilities, and 3) social relationships in which the knowledge processes occur (Table 1). In this chapter, we study inter-firm networks by dividing a complex network of multiple actors into smaller units. This helps in seeing the essential structures behind the value creation on a regional level. We view IC as the capability of an organization to create, transfer, and implement knowledge. A capability approach is crucial to the new economy, where new innovations are an essential way to gain a competitive advantage.

The conception of knowledge is fundamentally different in each of the themes concerning the intellectual resources of organizations. In the intangible asset approach, knowledge is defined as a possession or property of the organization, typically consisting of human, structural, and customer capital (Brooking, 1996; Stewart, 1997; Sveiby, 1997; Bontis, 1999). The capability approach views knowledge as an ongoing and emergent process, where the capability to leverage, develop, and change intangible knowledge is defined as a possession or property of the organization, typically consisting of human, structural, and customer capital (Brooking, 1996; Stewart, 1997; Sveiby, 1997; Bontis, 1999). The capability approach views knowledge as an ongoing and emergent process, where the capability to leverage, develop, and change intangible knowledge is defined as a possession or property of the organization, typically consisting of human, structural, and customer capital (Brooking, 1996; Stewart, 1997; Sveiby, 1997; Bontis, 1999). The capability approach views knowledge as an ongoing and emergent process, where the capability to leverage, develop, and change intangible knowledge is defined as a possession or property of the organization, typically consisting of human, structural, and customer capital (Brooking, 1996; Stewart, 1997; Sveiby, 1997; Bontis, 1999). The capability approach views knowledge as an ongoing and emergent process, where the capability to leverage, develop, and change intangible

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Table 1: Three Approaches to the Determinants of Competitive Advantage in Knowledge-Based Economy

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<thead>
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<th>Capability Approach</th>
<th>Cibility Approach</th>
<th>Relational Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge understood as</td>
<td>Possession or property of the organization</td>
<td>Ongoing, emergent process</td>
<td>Socially constructed and shared resource</td>
</tr>
<tr>
<td>Main interest</td>
<td>Identification and valuation of existing intangibles</td>
<td>Capability to create, develop and modify intangibles</td>
<td>Social relationships and interaction</td>
</tr>
<tr>
<td>Focus on</td>
<td>Investments, intellectual property rights, human capital, structural capital, customer/relational capital</td>
<td>Adaptive and self-generative capability of the unit of analysis</td>
<td>Characteristics of the social relationships connecting the actors and social capital embedded in them</td>
</tr>
<tr>
<td>Research trends</td>
<td>Intellectual capital, IPR management, human capital statement</td>
<td>Dynamic capabilities, dynamic IC, organizational renewal ability</td>
<td>Social capital, inter-organizational networks, communities of practice</td>
</tr>
<tr>
<td>Representative authors</td>
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assets is important (Teece et al., 1997; Eisenhardt and Martin, 2000; Stähle et al., 2003). Finally, in the relational approach, knowledge is understood as a socially constructed and shared resource. The focus of the relational approach is on the social relationships connecting the various actors and the social capital embedded in these relationships (Brown and Duguid, 1991; Lave and Wenger, 1991; Nahapiet and Ghoshal, 1998; Cohen and Prusak, 2001).

In this chapter, we suggest a new capability and relationship-based view to the IC creation in a regional cluster. The regional cluster of small firms is studied in accordance with the network theories and the influence of social relationships and interaction on organizational success.

Recent studies show that new innovations are created in networks which combine different actors and resources (i.e., Lundvall and Borrás, 1998; Powell, 1998; Miettinen et al., 1999). There have also been suggestions that regional competitive advantage is related to the formal and informal networks between the actors in the region (McDonald and Vertova, 2001). In our research on a regional cluster, we set out to determine how IC is created between the actors in a region, by dividing the regional cluster of small firms into distinct entities according to their IC functions. The main goals of the case study were to define the kind of knowledge and competence the actors have, the nature of relationships between the actors, how information is transmitted, and how these processes are managed and coordinated.

Our solution for a new approach for understanding regional knowledge creation is a concept we call the regional knowledge system. This system includes knowledge implementation, knowledge transfer, and knowledge creation levels in a regional cluster of small firms. The region needs all of the levels to be successful. On the one hand, new knowledge is transferred from the knowledge creation level to the knowledge implementation level via the knowledge transfer level. On the other hand, new ideas for innovation emerge from the knowledge implementation level and are transferred to the knowledge creation level. In the regional knowledge system, we call these levels the production, development, and innovation network of the regional cluster.

This chapter presents a classification of three types of interorganizational networks, illustrates them with the findings from a case study, and introduces a novel approach to IC creation in regions. The research is a case study conducted during the winter of 2002 to 2003 in a regional cluster of small firms in eastern Finland. The case of this chapter is based on a research project coordinated by the Finnish Association of Graduate Engineers, TEK, during the years 2002 and 2003.

The Benefits of Inter-Firm Networking

The social scientist Manuel Castells defines network simply as a “set of interconnected nodes” (Castells, 1996, p. 470). Actors form nodes in any network structures, and transmit various types of flows to other actors in the network. Castells’ view about networks is related to his theory about the world as a “space of flows.” According to this theory, the world is going through global decentralization and reallocation of operations. Regions compete against each other in global markets and try to attract important flows to themselves. The most important type of flow is capital. Other flows can be, for example, competent employees and information (Castells, 1996). According to Castells (1996), actors in the markets can be divided into two categories: insiders and outsiders. Insiders are the ones who have managed to get into a network with growth opportunities. Outsiders are the ones left out to get the lowest bids.
The idea about insiders and outsiders is related to the concept of “markets as networks.” In this view, markets are dominated by alliances. These structures consist not only of buyers and sellers, but also of other actors such as consultants, service providers, and institutions. According to the markets as networks view, the markets of industrial products are complex networks of multiple actors. In these networks, relationships between the actors contain three main components: activities, resources, and actors (i.e., Håkansson and Johanson, 1992; Ford et al., 1998).

The roles of the different actors in the network can be defined on the basis of this distinction.

The economists Shapiro and Varian (1999) also see networks as a prerequisite for succeeding in competition. In the new economy, the markets are dominated by networks that gain strength as more actors join the network. In the economy dominated by alliances and networks, the value of a product is dependent on the amount of other users of the product. It is better to be connected to a bigger network than a smaller one. Typical examples of this effect are communication technologies, such as telephone, email, and fax (Shapiro and Varian, 1999).

Alliances that several different actors form in the markets divide the old model of value chains introduced by Porter in 1985. When the markets are seen as networks, the actors in the network can consist of many other types of actors than traditionally thought. The actors include not only the focal firm but also customers, suppliers, hardware suppliers, institutions, and so on, which are all important for the whole network. The information flows between all of the actors in the network.

The Porterian value chain theory (Porter, 1985) is based on the old industrial tradition. In Porter’s view, raw material is processed in different phases of production, where every phase adds the value of the final product. The Porterian value chain theory is usable with physical raw material, due to the fact that physical raw material can be moving only in a certain direction at a time and it can be located only at a certain point at a time.

The main difference between the Porterian value chain theory and the concept of value networks is that the value chain theory did not take into account the fact that the flows between the actors can also be intangible and the information can be flowing between all the actors. The value network generates economic wealth with complex exchanges between the actors involved in the network. The value chain and network are also different in terms of social relations. For example, Allee (1999) argues that in the old industrial world, trust could be expendable in a short-term benefit. In the transparent world of value networks, even an occasional loss of trust may be harmful in unexpected ways.

Network-based alternatives for the value chain model have been presented by numerous scholars (i.e., Prahalad and Hamel, 1990; Allee, 1999; Allee, 2000; Nor- mann, 2001; Allee, 2002; Pernes, 2002). The key components common for all value network-based models are that they emphasize the combination of different resources and competence. Small firms will be able to compete against big corporations only by realizing their core competencies (Prahalad and Hamel, 1990; Hamel, 2000). According to Hamel (2000), all new and revolutionary business models are a just a novel, innovative way to combine old ideas, resources, and competence from different actors and fields of businesses.

Being an active actor in a value network in a regional cluster of small firms provides the actors with numerous benefits. First, according to the theory of transaction costs and from the strategic alliance point of view, networks lower the transaction costs of
the actors by allowing them to concentrate on their core competencies. Second, according to social capital theories and research, the networks in a regional cluster initiate learning from other actors with trustworthy and communicative relationship-ships. Third, according to research on innovation processes, a regional cluster of small firms provides an opportunity to continuously improve products, production methods, and processes by providing conditions for combining different resources and knowledge.

The First Benefit of Networks in a Regional Cluster: Lower Transaction Costs

In a regional cluster of small firms, interorganizational networks lower the transaction costs by allowing the actors to concentrate on their core competencies. The actors form strategic alliances with each other. In strategic networking, cooperation is developed and organized according to the shared objectives of the actors involved. Strategic cooperation is extended to all levels in the subcontracting network and the relationships are seen as significant investments, which makes them long-term and carefully chosen. (Paaja, 1999; Luomala et al., 2001)

Networking for strategic competitive advantage differs from other forms of cooperation. According to Hyytiäläinen and Simons (1998), the other forms of cooperation are: 1) bidding contest for subcontractors, 2) subcontracting cooperation, and 3) partner-type of cooperation. All of the three other forms of cooperation are dyadic in nature, but in strategic networking dyadic relationships are expanded to the level of multilateral cooperation.

The transaction cost theory provides one solution for understanding inter-firm cooperation (for theory, see, e.g., Coase, 1937; Williamson, 1975; Williamson, 1981; Williamson, 1985). The basic idea behind the transaction cost theory is that organizations try to minimize their total costs, which are formed by production and transaction costs. Transaction costs can be seen as “friction of the economy,” and they have to be minimized. According to the transaction cost theory, as the cost of capital rises, the transaction costs also rise (Williamson, 1985; Schienstock and Hämäläinen, 2001).

Market-based controlling of actions is good when the capital costs and transaction costs are low. In the market-based model, the firm buys the material and parts needed in production, and then sells the products in a market where the buyers and sellers stay anonymous. Hierarchies function best in the kind of businesses where high capital costs and high transaction costs prevail. In the hierarchical model, the firm controls the whole production chain from raw material acquisition to the selling of the product. Networks, on the other hand, are a good option to control actions when the business involves average capital and transaction costs (Coase, 1937; Williamson, 1975; Williamson, 1985; Schienstock and Hämäläinen, 2001).

In Jarillo’s (1988) opinion, networks are the ultimate way to organize business, if the company is able to create a system which lowers the transaction costs of the firm, outsources functions to the best subcontractors, and keeps the firm-specific core competence inside the firm. When networks are used consciously to gain competitive advantage, Jarillo calls them “strategic.” Essential for Jarillo’s strategic network is that there is a focal company which has started the cooperation. The focal company then maintains long-term relationships with the companies in its network to gain the trust of the subcontractors and to lower the transaction costs. The companies in the network specialize in their own core competence.
The Second Benefit of Networks in a Regional Cluster: Learning From Others

The second benefit that networking inside a regional cluster offers is learning from other companies through the mechanisms of social capital.

The basic idea behind social capital is similar to the old saying: “it's not what you know, it's who you know.” A well-constructed social network opens doors to sources of information which would normally be unreachable. With this information, an actor gains a competitive advantage, because they know more than others. With the information gained from the social network, the social capital that the actor possesses is transformed into the personal human capital of the actor (Johanson, 2000).

Putnam (1995, pp. 664–665) defines social capital as “features of social life – networks, norms, and trust – that enable participants to act together more effectively to pursue shared objectives.”

Nahapiet and Ghoshal (1998, pp. 251) present the same idea in the context of organizations. Organizations foster social capital, and firms that have high social capital gain a competitive advantage. Nahapiet and Ghoshal also divide the concept of social capital into three different components slightly similar to Putnam’s definition, although they call the components structural, cognitive, and relational dimensions of social capital.

In his comprehensive literature review, Ruuskanen (2001) argues that the components of social capital create advantages through two mechanisms that are connected to each other: trust and communication. In his opinion, trust towards other people and formal or informal institutions is essential. The information flow in the network and the capability of the actors to understand each other is also essential. In addition, Ruuskanen states that communication in the network and trust between the actors are especially important on a regional level.

The components of social capital have been argued to enhance learning and productivity among the actors in the network. Yli-Renko et al. (2001) have studied the power of social capital in explaining the development of a competence-based competitive advantage in new technology firms. They conclude with the data of 180 new technology firms in Great Britain that social interaction, customer network ties, and the quality of the relationships have a statistically significant connection to learning in key customer relationships. They also note that learning in the relationship significantly explains the competitive advantage (Autio, 2000; Yli-Renko et al., 2001). Autio (2000, p. 47) even states that the correlation between social capital and the learning benefits gained from social capital explain the fact that technology-based firms tend to be concentrated in specific regions.

However, as forging and maintaining social capital entails significant costs, it may not always improve financial success. When studying 143 Finnish firms Pöyhönen and Wäijakoski (2004) found that social capital was related to organizational growth only in those cases where the firms either had extensive collaboration with their most important business partner, or belonged to an established interorganizational network. In other cases, the costs of social capital neutralized its positive effects.

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The Third Benefit of Networks in a Regional Cluster: Continuous Innovation

A regional cluster of small firms provides an opportunity to continuously improve products, production methods, and processes by providing conditions for combining different resources and knowledge. Innovations have a social character and innovations today require highly specialized knowledge from different fields. For example, in 1901 81% of U.S. patents were issued to independent inventors, but in 1980, individuals acquired only 20% of new patents (Whalley, 1991, p. 208). Powell (1998, p. 229) argues that new innovations are not even created in individual companies, but in the networks of multiple companies and actors. Miettinen et al. (1999) studied innovations in several Finnish projects, and the conclusion of this study was that most of the new knowledge creation occurs in networks. It has also been argued that regional networks have an important role in the competitive advantage and innovativeness (Lundvall and Borras, 1998; McDonald and Vertova, 2001). According to Lundvall and Borras (1998, p. 109) the regional dimension is important for new innovations because of three reasons. First, the creation of human capital requires geographical proximity. Second, geographical proximity increases the possibility for casual and planned meetings, as well as spontaneous and structured information exchange, and thereby increases the emergence of formal and informal networks. And third, synergies can emerge from the shared cultural, psychological, or political perspectives of those engaged in the same industry within the same economic space or region.

Production, Development, and Innovation Networks

In this section, we will present the theoretical background for our theory of three types of networks in a regional cluster. According to the value network approach introduced by Allee, and some of the network theories previously described, we also suggest three main purposes for networking in a regional cluster.

Allee’s Theory on Value Networks

Allee’s work with value networks (1999; 2000; 2002) is one of the most recent contributions towards understanding the complex networks that generate value. In her opinion, any organization can be understood as a value network (2000). Her view is based on the idea that dynamic exchanges of goods, services, knowledge, or intangible benefits create value in a network. It is also possible to map all of these dynamic exchanges, which makes understanding and measurement of the value networks possible.

Allee sees organizations in new economy as living systems, which is a totally different point of view than defining organizations as traditional mechanistic ones. She describes organizations as living systems, and bases this account on Capra’s (1996) theories about the definition of a living organism, and with the concepts of the autopoietic network and the dissipative structure of a living system from the systems theory literature. According to Allee’s model, organizations are combinations of actors

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with tangible and intangible exchanges flowing between them. When compared to a living organism, tangible flows are flows of energy and matter in the organization. Intangible flows, such as knowledge, make the organization intelligent as a living system. The intangible flows also prove that the organization is capable of taking conscious actions (Allee, 2002).

By relating Allee’s views about value networks with the theory about network-based alternatives for the value chain, to the concept of “markets as networks” and the social character of innovations, three main purposes for value networks can be described. A regional cluster can be seen as a value network where the flows between the actors are not only tangible, but also intangible.

The first purpose for a value network is to generate value, that is, to bring cash flow to the system and make a profitable business. As previously described, the value creation process in value networks is different from the traditional value chain introduced by Porter (1985). In the value network, intangible benefits and knowledge support the exchange of goods and services to money. This makes it possible to combine different resources and competencies in innovative ways to generate value for the network.

The second purpose of a value network is to ensure that information is transferred between the actors. Intangible flows, such as strategic information and process-related information, are byproducts of tangible flows, which help to form relationships to exchange information and make the organization run smoothly. According to Allee (2002), intangible flows are important, because they make the system “alive”.

The third purpose of a value network is to bring different actors and resources together. According to the “markets as networks” (Ford et al., 1998; Shapiro and Varian, 1999) point of view previously described, the network is more valuable when it encompasses more actors, and according to theories about innovation networks (i.e., Lundvall and Borràs, 1998) new innovations emerge from the combination of highly specialized knowledge from different actors. Dynamic exchanges of tangible and intangible flows attract more actors to join the network.

Knowledge Environment of a System

In her 1998 dissertation, Ståhle proposed a theory about the self-renewal ability of groups and organizations. By analyzing system theories, she was able to define four basic determinants for organizations: 1) knowledge and competence, 2) relationships, 3) information flow, and 4) management and leadership method (Ståhle, 1998; also see Ståhle & Grönroos, 2000, Ståhle et al., 2003). Ståhle’s main theoretical contribution is that in organizations there are different environments, where organizational determinants are different. These environments are 1) a mechanic, 2) organic, and 3) dynamic environment. Ståhle labels them the “knowledge environments of an organization.” Every environment has its own way to produce value with knowledge, which we call the “IC-related function” (Poyhonen, 2004; Poyhonen and Smedlund, 2004). In the mechanic category, the IC-related function implements knowledge into practice as effectively as possible. In the organic category, it transfers knowledge inside the organization. The IC-related function of the dynamic category is to create new knowledge. In order to be successful, an organization has to have each type of knowledge environment present. This means that the organization has to: 1) implement knowledge, 2) transfer knowledge, and 3) create knowledge in order to continuously renew itself. With continuous self-renewal the organization is able to produce new innovations according to the needs of the markets and find a competitive advantage.

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The differences between the knowledge environments and the organizational determinants are summarized in Table 2 below. In order to be efficient in knowledge implementing, the actors in the mechanic knowledge environment have to have defined, explicit knowledge about what they are doing. An example of an organization with mechanic system logic is a factory. In a factory, it is important to produce something that has already been designed as efficiently as possible. To do this the factory needs knowledge, relationships, information, and leadership similar to mechanic system logic.

To transfer knowledge between actors, the organic system logic has to be led with dialogue and empowerment. This means that in the organic environment, the relationships are of the consensus-seeking type, and the actors have their own tacit form of knowledge. For example, in a service organization it is important to learn from the experiences of others and improve customer service step by step. A service organization can be steered more towards organic system logic.

On the dynamic, knowledge-creating level it is important to have a great amount of intuitive and potential knowledge. Relationships are spontaneous and abundant. Information flow is chaotic and it is managed by networking and relinquishing of power. An example of an organization with dynamic system logic would be an advertising agency that has to constantly design new ideas.

Every organization has to have all of the knowledge environments present in order to be successful. This means that even if a factory has a mechanic systems logic emphasized, it needs characteristics from organic and dynamic knowledge environments as well. According to Ståhle and Grönroos (2000), the dynamic knowledge environment is in key position for continuous innovation. On the other hand, an organization needs an organic and dynamic knowledge environment as well to turn innovations into profitable business.

**Production, Development, and Innovation Network**

In a regional setting, three basic network types can be distinguished. These types function as knowledge creation, knowledge transfer, and knowledge implementation.

**Table 2: Knowledge Environments, IC Functions and Organizational Determinants (Based on Ståhle and Grönroos, 2000; Pöyhonen and Smedlund, 2004)**

<table>
<thead>
<tr>
<th>Knowledge environment</th>
<th>IC function</th>
<th>Knowledge and competence</th>
<th>Relationships</th>
<th>Information flow</th>
<th>Management and leadership method</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanic</td>
<td>Implement knowledge</td>
<td>Defined, explicit</td>
<td>Determined by hierarchy</td>
<td>One-way, top-down</td>
<td>Orders, direct use of power</td>
<td>Factory</td>
</tr>
<tr>
<td>Organic</td>
<td>Transfer knowledge</td>
<td>Experiential, hidden, tacit</td>
<td>Reciprocal, seeking consensus</td>
<td>Multi-way, horizontal</td>
<td>Dialogue, empowerment</td>
<td>Service organization</td>
</tr>
<tr>
<td>Dynamic</td>
<td>Create knowledge</td>
<td>Intuitive, potential</td>
<td>Spontaneous, abundant</td>
<td>Chaotic, sporadic</td>
<td>Personal networking skills, relinquishing power</td>
<td>Advertising agency</td>
</tr>
</tbody>
</table>

The differences between the knowledge environments and the organizational determinants are summarized in Table 2 below. In order to be efficient in knowledge implementing, the actors in the mechanic knowledge environment have to have defined, explicit knowledge about what they are doing. An example of an organization with mechanic system logic is a factory. In a factory, it is important to produce something that has already been designed as efficiently as possible. To do this the factory needs knowledge, relationships, information, and leadership similar to mechanic system logic.

To transfer knowledge between actors, the organic system logic has to be led with dialogue and empowerment. This means that in the organic environment, the relationships are of the consensus-seeking type, and the actors have their own tacit form of knowledge. For example, in a service organization it is important to learn from the experiences of others and improve customer service step by step. A service organization can be steered more towards organic system logic.

On the dynamic, knowledge-creating level it is important to have a great amount of intuitive and potential knowledge. Relationships are spontaneous and abundant. Information flow is chaotic and it is managed by networking and relinquishing of power. An example of an organization with dynamic system logic would be an advertising agency that has to constantly design new ideas.

Every organization has to have all of the knowledge environments present in order to be successful. This means that even if a factory has a mechanic systems logic emphasized, it needs characteristics from organic and dynamic knowledge environments as well. According to Ståhle and Grönroos (2000), the dynamic knowledge environment is in key position for continuous innovation. On the other hand, an organization needs an organic and dynamic knowledge environment as well to turn innovations into profitable business.

**Production, Development, and Innovation Network**

In a regional setting, three basic network types can be distinguished. These types function as knowledge creation, knowledge transfer, and knowledge implementation.

**Table 2: Knowledge Environments, IC Functions and Organizational Determinants (Based on Ståhle and Grönroos, 2000; Pöyhonen and Smedlund, 2004)**

<table>
<thead>
<tr>
<th>Knowledge environment</th>
<th>IC function</th>
<th>Knowledge and competence</th>
<th>Relationships</th>
<th>Information flow</th>
<th>Management and leadership method</th>
<th>Example</th>
</tr>
</thead>
<tbody>
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levels in a regional cluster of small firms. As previously described in our first article about IC creation in regions (Pöyhönen & Smedlund, 2004), the three network types are different from each other in terms of their structure, IC-related function, and Ståhle's (1998; 2000; 2003) knowledge environment. The different network types are summarized in Table 3. We name these three different network types production network, development network, and innovation network.

In our approach, the sales process is always considered to be in the production network. In the production network, the flows between the actors are related to the production of a product, so they consist mostly of physical products or money. All of the information flowing between the actors is related to production, e.g., information about stock levels. The production network can be dominated by a single, central actor, or the network can be coordinated by a broker outside the actual network setting. The actors in the production network do not necessarily know all of the other actors involved. The relations in the network are based on dyadic relationships between an actor of the network and the dominating actor or the broker. The network structure is hierarchical. The essential characteristic of the production network is that it serves as an effective manner to produce a pre-designed product or service.

Ideally, a production network functions as mechanistic machinery (Ståhle & Gronroos, 2000), which efficiently produces permanent quality and achieves predetermined goals. In order to do this, the network necessitates clear and coherent rules and regulations. Thus, the essential knowledge of the production network should be in explicit form and circulated to all relevant actors. It is enough that information

<table>
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flows in one direction, mostly top-down, because discussion and elaboration open up the possibility for modifications, which in this type of network are unwanted and mere hindrances to its effectiveness. This kind of operational mode is facilitated by centralized control and hierarchical structure.

The development network is a horizontal network construct that can be used for joining together firms in a regional cluster, even if they do not have cooperation in the production function. The actors in a development network can even be competitors. In the development network, the actors share information that benefits all of the actors individually. The flows between the actors in the development network are intangible by nature. The flows can be, for example, information about the production methods and customers, or personal know-how of the actors. The development network is the only type of network where there are no tangible flows between the actors. By learning the best practices of others, firms can achieve a higher level of efficiency. In a regional setting, a development-focused network can improve the actors’ performance in, for example, marketing or acquisition of venture capital. The essential characteristic of the development network is its knowledge-sharing nature.

The development network resembles Ståhle's and Grönroos's (2000) account of organic knowledge environment within organizations. The continuous development conducted in the organic environment is based on tacit knowledge, lateral two-way information flows, double contingent relationships, and empowering leadership. Similarly, in the development network, the actors’ capabilities develop over time as they learn from each other’s experiences. The relations are reciprocal and based on trust rather than on detailed formal agreements. Cooperation is conducted in everyday casual communication between the actors, and active participation is encouraged. In the development network, there is no single dominating actor. However, there can be a coordinator that supports knowledge sharing.

In the innovation network, new knowledge is created and new solutions for problems are developed consciously in cooperation with the actors involved. The flows between actors are related to the innovation process at hand. The flows can be samples of products, research knowledge, or experimental knowledge. The relationship structure in an innovation network is diagonal. This means that the actors participating in the innovation network are from different production chains and different industries. The innovation network can also tie together institutional and entrepreneurial actors.

The innovation network should master the creation of knowledge that is novel for everyone in the network. This requires that there is room for creativity and that the operational mode of the network is not too structured and formalized. Along the lines of Ståhle’s and Grönroos’s (2000) description of dynamic knowledge environment, potential and intuitive knowledge, even self-transcending knowledge (Scharmer, 2001), should be highly valued. The relations are informal and rich and the actors’ capabilities are multi-layered. The innovation network should be led by the actor who is the most suitable for coordinating the resources and knowledge, i.e., authority migrates according to expertise rather than position in the hierarchy.

The Case

The idea of production, development, and innovation networks was applied to a case cluster. The main research problem was to determine whether it is possible to divide the inter-firm cooperation which occurs in a specific region into these three network types. Our goal in the case region was to map all of the actors involved, model the relationships between the actors, and find the strengths and weaknesses of the cooperation.

Chapter 14 Intellectual Capital Creation in Regions: A Knowledge System Approach
Background
The case region is a relatively young cluster of small firms located in the eastern part of Finland. The firms in the cluster operate in the mechanical wood processing industry, which is a traditional field of business dominated by a few large corporations. At least in Finland, there has been very little network-based cooperation in this particular industry, and almost all previous attempts to form network arrangements between small firms have failed (Passila, 1998).

In March 2003, there were eight internal actors involved in the cluster. All of the internal actors were situated within approximately 100 yards from each other in the same industrial area provided by local municipalities. Four of the actors were small manufacturing firms that manufactured end products (sawn timber) to the market. All of the manufacturing firms had slightly different raw material requirements and products, so they were not in direct competition with each other. One of the actors was a service provider that managed one phase of the production (the drying of the timber) for the manufacturing firms. The raw material acquisition firm was owned jointly by all of the municipalities in the region. One of the actors rented labor and machinery to all of the other actors in the area. In addition, there also was a university’s research laboratory in the same industrial area.

The case cluster was a collaboration bringing together several regional actors: local entrepreneurs, venture capitalists, and institutional actors. The main institutional actors were several local municipalities and a local university. Compared to their overall budgets, the local municipalities had invested heavily in the formation of the cluster.

Figure 1 provides an overall view of the region and shows what the relations looked like in March 2003. The illustration was made according to Allee’s value network approach recommendations, except that the flows are pictured with two-headed arrows. Allee does not like two-headed arrows, because they do not tell anything about the direction of the flow (Allee, 2002, p. 9), but we have used them in this overall picture to make the figure readable. In this picture, the arrows represent the existing relationship between the actors. Internal actors (actors within the same industrial area) are depicted as circles and external actors (actors outside the industrial area) are depicted as ovals.

In designing a network graph, it is always difficult to decide which actors belong to the network and which do not. We solved this problem by including only the actors that the interviewees mentioned. The gray area in Figure 1 illustrates the industrial area. The actors in this area were located only approximately 100 yards from each other. The actors outside the gray area were located somewhere else, but the internal actors considered them important. The role of the development company owned by the local municipalities was considered important by the interviewees. The development company had been in an essential role in the formation of the region.

Methods
We examined the case region according to the socio-centric network perspective, which means that we assessed the benefits of networking from the viewpoint of the whole network, not from the actor-centric perspective of an individual organization (Adler and Kwon, 2002). The research method was a case study. The data was gathered with 11 theme-based interviews and site visits. As a part of the theme-based interview, the

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interviewees were asked both to draw a graph of how they perceive the network and to verbally explain the connections and flows between the actors. Some of the interviewees commented on a graph made by us. Based on these graphs and the related explanations, an overall presentation of the cluster and the three network types identified within it were modeled using Allee’s (2002) value network approach model. The interview themes were constructed on the basis of the knowledge environment theory by Ståhle and colleagues (Ståhle and Grönroos, 2000; Ståhle et al., 2003). The IC creation process in different network types was thus studied from the viewpoints of: 1) what kind of knowledge and competence the actors had, 2) what the nature of relationships between the actors was, 3) how information was transmitted, and 4) how these processes were managed and coordinated.

Based on the organizational determinants introduced by Ståhle, we were able to make two important conclusions about the case region. First, we were able to discern the systemic logic according to which the various types of networks within the cluster were functioning. And second, we were able to find specific strengths and weaknesses in the operation of the different network types. As a byproduct of the theme-based interviews, we also managed to define the strategic goals for the different network types.

**Case Production Network**

The production network was the heart of the whole region. With the operation of the production network, the final products were sold to the customers and money was
flowing to the region. All of the manufacturing firms in the case region followed the production network logic described in Figure 2.

In the production network of the case region, the manufacturing firm buys raw material from the raw material acquisition firm, uses the service provider to make one phase of the production, and then sells the finished product to the customers. The labor and machinery firm provides labor and machinery services for the manufacturing firm and raw material acquisition firm.

Most of the flows in the production network are tangible (products, money, machinery, or labor). Intangible flows related to production are production-related information about stock levels, capacity, and need.

After drawing the picture of the typical production network in the region, we noticed that the production related information flow was not working properly. For manufacturing firms, it is important to know what type of raw material is available and when. Information about stock levels in the raw material acquisition firm helps the manufacturing firms in production planning and saves the costs of production significantly. In the case production network, information about the stock levels was circulated through the labor and machinery firm, which caused problems for the manufacturing firms. In the most favorable situation, the information would have to flow directly from the raw material acquisition firm to the manufacturing firm. On the other hand, the information flow between the service provider and the manufacturing firms was satisfactory. The manufacturing firms informed the service provider about the needs for services and the service provider told the manufacturing firms about the

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**Figure 2**

Production network according to Allee's (2002) value network model.
service capacity. The service provider had limited capacity, so it was important for it to know the service need and urgency.

Considering competence, the production network had good preconditions, because none of the manufacturing firms competed directly with each other. All of the manufacturing firms had different products and needs concerning the type of raw material. The only competence-related problem in the production network was that the core competencies were not clarified in every manufacturing firm. It seemed that some of the manufacturing firms had machinery that they did not necessarily need. A lack of clear agreements about transactions caused unnecessary disputes between the raw material acquisition firm and the manufacturing firms. Despite the fact that the whole region was originally built around the centralized raw material acquisition firm, some of the manufacturing firms considered the centralized raw material acquisition as a threat. As a whole, the relationships in the production network were not very good. Some of this was merely caused by the lack of information from the acquisition firm to the manufacturers.

The management and leadership of the production network should always be in the hands of the firm who sells the final product to the customer. This was not the case in the region. The raw material acquisition firm had a too dominating role in the production network.

Case Development Network

The development network level represents the social and informal side in the cooperation between the actors in a region. In principle, all of the actors in the same geographical region should be included in a development network in some way or another. In the most favorable situation, the actors in the development network exchange information with all of the other actors in the same region.

In Figure 3, the two-headed arrows were used because of practical reasons to illustrate the development network in the case region. In this figure, the two-headed dotted line illustrates the knowledge exchange between the actors. Some of the actors had close relationships to a few external actors as well, so we included them in the figure.

As with the production network, we can again make important observations about the information flow in the region just by examining the figure of the development network. In the development network setting, the manufacturing firms communicate with each other daily. The manufacturing firms exchange experiences continuously and the geographical proximity makes the knowledge exchange easy. The raw material acquisition firm, the development company, and the service provider also exchange information regularly.

The development company owned by the local municipalities was an important actor during the creation of the region. The development company still tried to lead the informal communication and knowledge sharing between the actors by bringing the actors together in common meetings. The entrepreneurs in the manufacturing firms did not like these meetings and some even thought that they were useless.

The university’s research lab functioned as a link between the two cliques in the region. This setting had many negative consequences to the functioning of the whole region. Trust between the cliques was not very good, which hindered all communication and processes between the cliques. The role of the university’s research lab sometimes seemed to be just that of a referee in the disputes between some of the
actors in the region. For some reason or another, it seemed that the problems in the production network level caused friction to the relationships and a couple of persons had a bad reputation among the manufacturing firms. The university's research laboratory, on the other hand, was quite trustworthy in the eyes of the manufacturing firms. The researchers from the university had been sharing production-related knowledge since the foundation of the region.

All of the entrepreneurs in the region had different backgrounds and know-how about the field of business. Knowledge about the raw material the region processes was quite rare, and some phases of production were still unclear. The region used birch as raw material, but most of the manufacturing firms had experience only of pine wood. The region needed a good atmosphere for knowledge sharing, because the actors needed to improve their material and process-related knowledge constantly. The manufacturing firms learned some production-related issues from each other and technical problems were in some cases solved in a group. Some of the manufacturing firms were considering a united marketing force. In March 2003, the manufacturing firms had a couple of shared customers, but normally every firm was selling their own products to their own customers. It would be possible to form a shared marketing function, if the firms would share their marketing knowledge with each other. A shared marketing function between the manufacturing firms would benefit all of the manufacturing firms. Together, the firms could offer larger quantities of products to the market. A shared marketing function would also let the manufacturing firms concentrate more on their core competencies, because they could use each others' products in case a customer needed them.
Case Innovation Network

The innovation network combined different resources and knowledge to create solutions for production-related problems. Although the core of the innovation network was inside the region, it had actors from outside the region as well.

Figure 4 is just one example of an innovation process in the region that the interviewees shared with us. In our case (Figure 4), a manufacturing firm noticed a quality-related problem in the semi-finished product that the service provider handled. The manufacturing firm then told the university’s research laboratory about this problem. The university’s research laboratory used the manufacturing firm’s tacit knowledge (know-how), theoretical research knowledge from other research projects, and funding from the financiers to solve the problem.

Some notes about the relationships and information flow in the region can be made on the basis of Figure 4. The university’s research laboratory had a dominating role in this particular innovation example. Most of the flows between the actors were intangible by nature (information, research knowledge, and know-how) and the research laboratory seemed to dominate them. The research laboratory had the leadership of the innovation process. Considering the information flow, the region benefited from the short distances between the actors. The geographical proximity made communication easy, and face-to-face knowledge sharing was very common. Even the research knowledge was usually transferred in oral form. This was seen as a good thing, because written research reports tend to stay unread by the entrepreneurs.

The competence of the innovation network was the research laboratory’s theoretical research knowledge and the empirical tacit knowledge of the entrepreneurs. The research laboratory and the other actors had symbiotic relationships in the region, and the interviewees thought that everybody benefited from the presence of the research laboratory in the area. From the point of view of the research laboratory, the region was quite a rewarding place for new research ideas. Day-to-day communication with the manufacturing firms provided many new ideas that are usually difficult for a researcher at a university to obtain.

The relationships in the innovation network were good. The informal relationships enhanced the communication between the researchers and the entrepreneurs. The manufacturing firms also used other types of services of the researchers frequently and the researchers were appreciated among all the actors in the region.

The Strengths and Weaknesses of the Production, Development, and Innovation Networks in the Case Cluster

By using Allee’s (2002) value network approach and Stähle’s (1998; 2000; 2003) organization determinants, we were able to divide the regional cluster into three distinct network types according to the model previously. We were able to find the strengths and weaknesses of the operation of the different network types by using: 1) knowledge and competence, 2) relationships, 3) information flow, and 4) management and leadership method as criteria. The findings are summarized in Table 4.

In summary, the greatest weakness of the production network was poor information flow about stock levels between the actors. The relationships in the development network were not very good due to some production-related problems, and the leadership of the innovation network was still in the hands of one actor. To ensure the future success of the case region, the organizational determinants of production,
Figure 4

Innovation network according to Allee's (2002) value network model.
Table 4: Strengths and Weaknesses in the Operation of Three Identified Network Types Within the Case Cluster (Ståhle et al., 2003; Pöyhönen and Smedlund, 2004).

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<th>Development network</th>
<th>Innovation network</th>
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<td>CASE</td>
<td>Defined, explicit</td>
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**CASE**
- **Knowledge and competence**
  - Actors' core competencies have not been clarified and internal production processes are not as efficient as possible.
  - Tacit knowledge of diverse actors is combined with theoretical research knowledge to create innovations.

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**Relationships**
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  - Agreements between the focal company and subcontractors are unclear.
  - Lack of trust between some actors hinders collaboration.
  - Plenty of personal and casual relationships between almost everyone. Researchers are highly appreciated by other actors.

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**Information flow**
- **Production network**
  - One-way, top-down
  - Multi-way, horizontal
  - Chaotic, sporadic

**CASE**
- **Information flow**
  - There are two separate cliques in the area, which do not communicate directly.
  - A lot of real-time communication and problem-solving. Quick reaction time to problems arising from entrepreneurs.

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**Management and leadership method**
- **Production network**
  - Orders, direct use of power
  - Dialogue, empowerment
  - Personal networking skills, relinquishing power

**CASE**
- **Management and leadership method**
  - The raw material acquisition firm has too much power over the manufacturing firms' processes, even though it is not the focal company of the network.
  - The development company has the leading position. The other actors are not empowered and active enough.
  - The university's research laboratory coordinates innovation process in a manner that respects the needs of the other actors.

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development, and innovation network should be led towards the basic criteria deter-

Strategic Goals for the Production, Development, and Innovation Network

According to the interviews and the observation, we were able to define strategic goals for the different network types in the region. These were to get the material flow as effective as possible, form a united market force, and develop new technologies for a certain phase of production.

The strategic goal of the production network in the region was to enable the raw material flow to be as effective as possible. The cooperation of the production network in the region was “strategic” in Jarillo’s (1988) terms, because the production liaisons were seen as a long-term investment of a profit-seeking nature. The production network was “strategic” also in the line of Hyötyläinen and Simons (1998). In their approach, strategic networking means fewer suppliers with more power. In the field of business our case region functions, the raw material acquisition is very capital intensive.

The strategic goal of the development network was to form a united marketing syndicate to the region. Big buyers do not want to buy products, if they cannot be sure that they receive enough products regularly. The small firms in our case region had problems in providing enough products to the market by themselves. According to the “markets as networks” view presented earlier (i.e., Håkansson and Johanson, 1992; Ford et al., 1998; Shapiro and Varian, 1999), the region could form one alliance for the market. This means that the region would seem like a single unit for the customers. The marketing syndicate would provide the actors “the economy of scale” together with the flexibility of a small unit, thus combining the benefits of a small and big firm.

The strategic goal of the case innovation network was to invent a new production method for the drying of the timber. This phase is difficult in the region’s field of industry. By reaching this goal the region would gain a pronounced competitive advantage against its competitors.

The Regional Knowledge System

Together, the different types of networks previously described form a system which we named the regional knowledge system. From the viewpoint of IC creation in regions, the regional knowledge system provides both a capability-based and a relational approach to the dynamics of regional IC creation. The system that the production, development, and innovation network together form in the region gives the region a better ability to create intangibles, renew itself, and adapt to the changes in the environment.

The region needs all of the three network types to reach a competitive advantage. On the production network level, the innovations invented in the innovation network are converted into profitable business. Innovation can be new products, production methods, or production processes. The role of the development network is to function as an intermediary between the production and innovation networks. With the social and learning-based character of the development network, new innovations are transferred to the actors, which can use them in production. Besides innovations, feedback and new innovation ideas are also transferred from the production level to the innov-
The benefits, purposes, IC-related functions, and case-specific strategic goals of networking in the regional cluster can be put into practice with the mindset the regional knowledge system provides.

Benefits, Purposes, IC Functions, and Strategic Goals of the Different Network Types

The network type of cooperation creates benefits for a regional cluster of small firms. These benefits were previously drawn from the existing network literature. When combined with the network typology presented in this chapter (also see Pöyhönen and Smedlund, 2004), we can link them to the production, development, and innovation networks in a regional cluster. First, the benefit of a functioning production network in the region is that it lowers the transaction costs by letting the actors concentrate on their core competencies. Second, the benefit of the development network is that this network type enables learning from other actors, with trustworthy and communicative relationships between the actors. Third, the benefit of the innovation network is that it facilitates continuous improvement of products, production methods, and production processes by combining different actors, knowledge, and resources.

Using the value network approach by Allee (1999; 2000; 2002) with the ideas from the “markets as networks” theory and the social character of innovations, we were able to argue that network based cooperation has three purposes. By linking these ideas with our network typology, we can bring these purposes to the regional level. The purpose of the production network is to create value by selling the products to the customers. The purpose of the development network is to ensure that the information supporting the value-creating process is transferred between the actors, and finally the purpose of the innovation network is to bring the different actors together to raise the value of the network as a whole.

We previously argued that every systems theory-based knowledge environment (Ståhle et al., 2003) has a distinct IC-related function. These can also be transferred to the regional level with the idea of our network typology. The IC-related function of the mechanic production network is to apply knowledge into practice as effectively as possible. The IC-related function of the development network, which functions according to organic systems logic is to share firm-specific transferable tacit knowledge. Finally, the IC-related function of the dynamic innovation network is to create new knowledge in collaboration with different actors and resources.

We were able to determine the strategic goals of our case region by analyzing the interview data. In our case region, in March 2003, the goal of the production network in the case region was to obtain the raw material flow as effectively as possible. The goal of the development network in the case region was to form one united market force to introduce more products to the markets than one actor could produce by itself. The goal of the innovation network was to develop better technology for a certain phase of production.

The three network types in the regional knowledge system function as: 1) IC implementation (production network), 2) IC transfer (development network), and 3) IC creation levels (innovation network) in the region. Each network type creates a certain type of knowledge-based competitive advantage and has its own operational logic and effectiveness criteria. Table 5 illustrates the benefits, purpose, IC-related function, and goals of the different network types in the case region.
Table 5: General Idea of Different Network Types in a Regional Knowledge System

<table>
<thead>
<tr>
<th>Network type</th>
<th>Benefit</th>
<th>Purpose</th>
<th>Intellectual Capital-Related function (Pöyhönen &amp; Smedlund, 2004)</th>
<th>Goal in the case region</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production network</td>
<td>Lowers transaction costs by allowing actors to concentrate in their core competencies.</td>
<td>Bring cash flow to the region. Make profitable business.</td>
<td>Apply knowledge into practice as effectively as possible.</td>
<td>Raw material flow as effective as possible.</td>
</tr>
<tr>
<td>Development network</td>
<td>Increases learning through trust and communication between the actors.</td>
<td>Ensure that information is transferred between actors.</td>
<td>Share firm-specific transferable tacit knowledge.</td>
<td>United market force.</td>
</tr>
<tr>
<td>Innovation network</td>
<td>Enables continuous improvement of products, production methods and processes by combining different actors knowledge and resources.</td>
<td>Bring together different actors and resources to raise the value of the network.</td>
<td>Create new R&amp;D of new technologies for a certain phase of production.</td>
<td></td>
</tr>
</tbody>
</table>

The three network types are not closed systems inside the region. A regional cluster consists of many overlapping production, development, and innovation networks, and some of the networks also have actors from outside the region. An actor in the regional cluster can simultaneously be a member in every type of network. In Figure 5, the ideal regional dynamics of the production, development, and innovation networks are presented. When the innovation network finds a solution for an individual actor’s specific problem, the solution is diffused, before long, to other the actors due to the knowledge transferring nature of the development network. On the other hand, innovation ideas constantly emerge from the production network when the actors share their day-to-day problems or ideas with each other. When the innovation idea reaches the right actor, that actor will form an innovation network with or without the original actor where the idea originated and try to find a solution to the problem.

Our findings in the case regional cluster indicate that the key to a successful regional knowledge system is a functioning development network. If the development network does not work properly, new ideas will “die” on their way to the person who might be able to offer a solution to the problem. The main task of the development network is to keep the communication and trust between the different actors on a good level. If the actors do not trust each other, they will not share any ideas or solutions.

According to Stähle and colleagues (Stähle, 1998; Stähle and Grenroos, 2000; Stähle et al., 2003), an organization must have all of the knowledge environments...
present in order to be successful. According to this idea, the innovations are born on the dynamic level of an organization with the right combination of information, competence, and creativity. On the organic level, the innovation is improved step-by-step, and on the mechanic level the innovation is put into production. In other words, innovativeness per se is not enough, but the organization also needs an organic and mechanic level to turn innovativeness into money. Similarly, the regional knowledge system needs production, development, and innovation networks in addition to the right actors to make the region competitive.

In our case regional cluster, the production network was dominant, but not the most important type of network in the cluster. The development network generated trust and communication between the actors with the sharing of knowledge, and the innovation network solved production-related problems. In our case region, the ideas for innovations were derived mainly from the production function. The presence of the university’s research laboratory and the joint projects with research financiers and firms also provided innovation ideas that the production function in the region would not need in the short-term. Naturally, all of the network types of cooperation between for-profit companies have a very clear main goal: to make profit. But without learning, sharing of knowledge, and continuous innovation, the production network cannot have a future.

Discussion

In this chapter, we presented a systems theory-based view for understanding the creation of IC in a regional cluster of small firms. In our opinion, a single actor can simultaneously be a member of different kinds of networks. In order to be successful, the regional cluster has to be able to: 1) make use of existing knowledge as efficiently as possible in a vertical production network, 2) transfer firm-specific knowledge and ideas in a horizontal development network, and 3) invent new knowledge, products, production methods, or processes in a diagonal innovation network.

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The production network forms the core processes of the region. On the production network level, knowledge is implemented to production to make products or services for the customers. With the development network, the actors in a region share information with each other and improve the societal capital of the region. In other words, on the development network level the actors form relationships, find a common language, and gain trust with each other. The new innovations produced on the innovation network level are transferred to improve the production methods with the knowledge-transferring nature of the development network.

When these network types are all present in a region, new innovations are transmitted to all of the actors to benefit each of them individually, and new innovation ideas constantly emerge. In this chapter, this cycle of innovations and innovation ideas between the production, development, and innovation network was named the regional knowledge system. Every network type in the region should lead towards the optimal situation in terms of competence, relationships, information flow, and leadership defined by Ståhle and colleagues (Ståhle, 1998; Ståhle and Gronroos, 2000; Ståhle et al., 2003) in their theory about different knowledge environments. When a regional cluster of small firms takes this into account, it makes the creation, transferring, and implementing of knowledge effective. In the optimal situation, the regional innovation network reacts to the problems in production almost immediately.

As a small cluster, our case region provided an easy opportunity to model different types of networks, and evaluate their critical factors. Our case region was dominated by a lack of trust and communication between the actors. This was partly due to the young age of the cluster. Some of the production-related problems caused trouble and made cooperation difficult. The main conclusion of the case study was that the development network level was the most important level in the case cluster. The development network can be seen as a prerequisite for trust and communication.

If the development network in the region is not in good shape, the other types of networks between the actors are difficult to manage as well.

The idea of a regional knowledge system described in this chapter provides a new set of tools for understanding the regional dynamics of IC creation. With this mindset, the strategy process of a regional cluster can be improved. When the complex value network inside a regional cluster is divided into smaller entities according to their IC function, it is possible to manage and understand the whole region more effectively.

The regional knowledge system allows us to identify the structure of a complex regional cluster more easily. By separating the production function from the learning or innovation levels, it is easier to improve each level separately. With this view, it is also possible to discover the core processes and competencies in the region that need improving. When successful, the regional knowledge system approach allows the combination of innovativeness and efficiency in a regional strategy process. Products can be produced at the same time as innovation processes occur, which improves the competitive advantage of the region.

To validate our approach to regional clusters, the idea of the regional knowledge system should be applied to a larger number of clusters. With more cases, we strongly believe that it would be possible to create an assessment tool to manage the overall strategy of a regional cluster. One promising route for future research could be the formation of standardized, quantitative measures.

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References

Chapter 14 Intellectual Capital Creation in Regions: A Knowledge System Approach


