Facing the Conflict of Transparency and Non-Disclosure of Knowledge within Value Creation Networks

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Notes: Knowledge Management; Value Creation Network; Value Co-Creation; Innovation and Value Creation; Distributed Manufacturing; Protecting Knowledge; Knowledge Exchange

Abstract: Collaboration of autonomous and specialized actors in value networks makes special demands on the joint use of knowledge resources. On the one hand, the actors wants to protect their competitive knowledge during the cooperation within the network. On the other hand, the distribution of knowledge must be ensured within the network in develop potentials for value co- creation. Based on a description model for an interconnected and open value creation this article discusses the conflict of objectives between the protection of knowledge and the availability of knowledge within a value creation network. Furthermore, a concept for inter-organizational cooperation is introduced which fosters the depth of cooperation and interaction between the actors within the network establishing save spaces for knowledge exchange and a common development of knowledge.

1) Introduction

In the second half of the 20th century industrial value creation was marked through a phase of digitization and the implementation of information and communication technology in the product creation processes [1]. This enabled an extensive automation of production processes. The design of the value creation processes within the company was based on the internal targets of cost, quality and time. The factory was like a black box, which optimized itself internally in cycles [2], [3]. However, we are facing an on-going paradigm-shift in value creation, which contradicts a consideration of the factory as a closed institution [2], [4], [5]. Innovations in the field of I&C technologies enable new forms of cooperation of distributed actors and offer new opportunities to the coordination of value creation processes across the boundaries of companies [6], [7]. New production technologies (e.g. 3D-printers, Micro- factories) enable individuals and small enterprises to produce industrial goods and to participate in industrial value chains [8], [9]. Furthermore, products consist more and more of intangible assets and many steps of the product development process can be performed in the virtual sphere (e.g. product development) [5], [10].

These drivers of change lead to new forms of industrial value creation which are characterized through increased interconnection and an intensive collaboration of autonomous actors (entrepreneurs, customers, suppliers etc.) in distributed structures and processes [2], [3], [11], [12]. Furthermore, the described paradigm-shift is characterized through an opening of value creation processes. Interconnection and openness are complementary strategies [2]. Following both strategies (interconnection, openness) will foster positive effects of emergence, which generate a higher added value. These positive effects are realized for example by using the potentials for coordination of individual operations along the value chain, creating transparency about the needs of the customers or the collaboration of autonomous and heterogeneous actors for a common development of innovations. [2], [5]

The transformation described represents great challenges for companies and their co-operation in networks and leads to conflicting interests. The single company fears to lose its competitiveness cause of a high degree of openness, due to the risk of unintentional discharge of competitive knowledge resources [13]–[15]. However, transparency and availability of knowledge is needed within the network to develop the potentials of value co-creation. Inter-organizational knowledge management must offer solutions to face this conflict. On the one hand, the competitive knowledge of the actors needs to be protected [15]. On the other hand, transparency, the distribution and generation of knowledge in the network must be ensured to support an efficient coordination of the activities within the network and to avoid a less productive networking of the actors.

2) Functioning of an interconnected and open value creation

Within the framework of a BMBF (Federal Ministry of Education and Research) sponsored research project a knowledge management system has been developed for the aeronautical cluster in Hamburg. The conflict between the protection of intellectual property and the development of cooperation capability has been analyzed during the study and has been taken into account developing a knowledge management system for the cluster. The regional cluster initiative Hamburg Aviation consists of the core companies Airbus and Lufthansa technics, Hamburg Airport, several research institutes and universities, as well as 300 small and medium-sized enterprises (SMEs), which are linked both vertically and horizontally with one an- other. The high density of heterogeneous competencies within the region offers many opportunities for common problem solving and development of innovations. However, the inter-organizational cooperation of actors within the cluster is often assessed to be inadequate.

As part of the development of a knowledge management system for the Hamburg aviation-cluster a qualitative interview analysis was carried out, for the purpose of collecting current requirements of the aviation industry in Hamburg [16], [17]. With regard to these changing requests, following aspects need to be emphasized: increasing competitive restraints, shortened product-life-cycles and innovation-cycles, shortened Ramp-Up phases, augmentation of product lines in aircraft manufacturing respectively individualization of demands as well as the internationalization of value creation. Moreover the specific characteristics of the industrial value creation (number of actors, power asymmetries between the actors, joint work and cooperation processes, positions and capacities of actors in net- works etc.) within the cluster were analyzed. All these features are hallmarked by the specialization of actors within their main businesses, by an increasing degree of product modularization plus an increasing degree of interconnectedness of actors in the supplier-network, especially beneath the 1-Tear supplier level. [18]

The understanding of the functioning of interconnected collaboration in a value creation network is crucial for the development of a knowledge management system for Hamburg Aviation. It is possible to describe value creation within networks from different perspectives [19]. It is possible to describe value creation networks as forms of organization which serve the coordination of value creation activities [20]. Networks are considered as a form of organization in addition to [21] or between [22] market and hierarchy [19]. Furthermore it is also possible to describe value networks as a configuration of social relationships between individual and collective actors and their position within the network structure [23]. This article uses a systemic perspective to explain value creation in networks. Using this approach it is possible to describe the necessary circulation of information between the system functions of a value creation system [24], [25]. These findings can be transferred to the organizational level of the network (actors or companies) in order to

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derive the requirements for knowledge work between the organizations in the network.

Consequently based on the requirements and features of industrial value creation in the aviation branch in general and the cooperation of agents in Hamburg in particular, a description model has been developed, which shows the patterns of functionality in networked and cooperative value creation of the aviation cluster Hamburg. The following description model is based on the premises of systems theory and the functioning of the viable system model (VSM) of Stafford Beer [24], [25]. The VSM describes the structure, the internal way of operating and the way of interacting with the environment of a viable system. A viable system is divided into five interacting subsystems. All of these five subsystems need to be realized in a system to ensure its viability according to Stafford Beer [5]. Figure 1 illustrates the structure of the VSM. The right side of Fig. 1 illustrates examples for an organizational implementation of the subsystems 1 – 5 in a company [25]. System 1 consists of the primary value creating activities of the system. Each primary activity of System 1 is itself a viable system. These primary activities (system 1) are controlled by System 2 – 5 [24], [27]. System 2 supports the self-organization of the primary activities through direct communication, standards and common rules. System 3 coordinates the primary activities using a comprehensive approach in order to use common resources efficiently and to achieve formulated strategic objectives. The changeability of the system is ensured by system 4, which identifies and develops potential success factors for the primary activities taking the dynamic environment into account. System 5 pro- vides a framework for the interacting subsystems and balances decisions and demands of the systems 1 – 4.

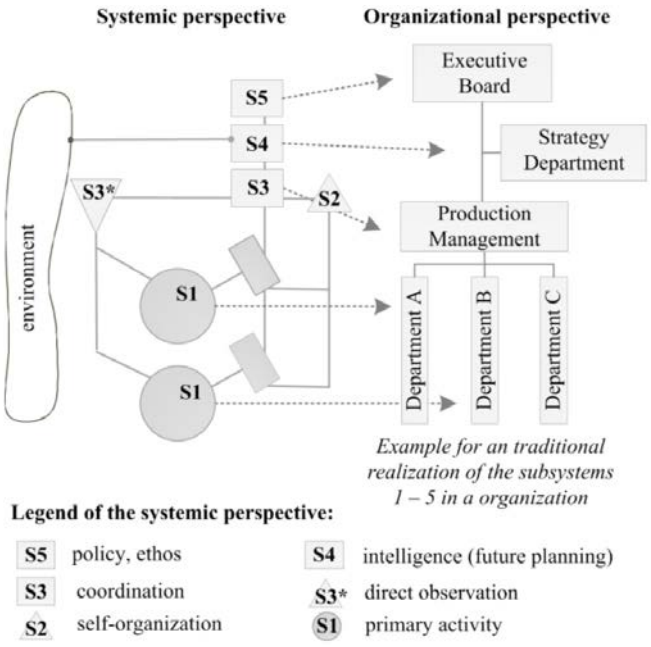

FIG 1: Structure of the viable system model

After the principal functions of the VSM have been explained the functioning of an interconnected and open value creation will be explained in detail. For this purpose the assumptions of the VSM are adapted to the context of an interconnected and open value creation.

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Figure 2 shows two different perspectives on the interconnected value creation in a network. The organizational level shows the organizations cooperating in the value creation net- work (e.g. companies, universities, public agencies, temporary collaborations units). The organization is defined as "a structured social system consisting of groups of individuals working together to meet some agreed-on objectives (Greenberg and Baron, 2003)" [28].

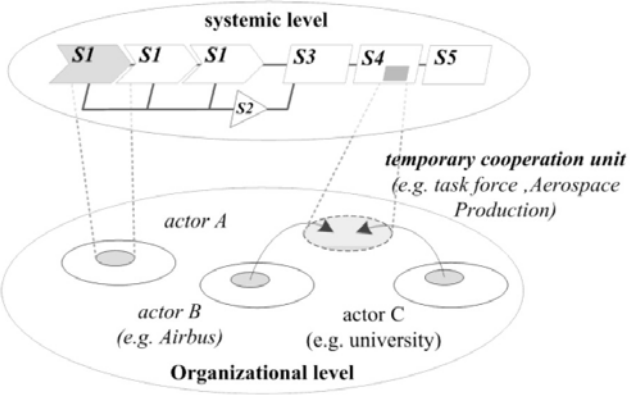

FIG 2: Organizational and systemic perspective on the interconnected value creation

The systemic level illustrates the different organizations and their interacting within the network building up a value creation system (viable system consisting of system 1 – 5). The following explanations show how the organizations of a value creation network (organizational level) perform and control the value creation process together (systemic level) [10]. The sum of the primary activities of the system (system 1) forms the inter-organizational value creation process. Each activity is one part of the common value chain and is performed by one actor of the network (see Fig. 2 – actor A performing primary activity of the value chain).

The value creation process (system 1) is controlled by System 2 - 5. The different operations within the value creation process (systems 1) and the controlling subsystems 2 – 5 are connected through information channels in order to perform the single system tasks ensuring mutual synchronization. While the primary activities (system 1) are performed autonomously by the actors of the network, the control of the system (system 2 – 5) requires the cooperation between the actors of the network due to the mutual dependencies of the single operations among the value chain [10], [27]. Apart from permanent institutions, which perform the tasks of subsystems 3-5 in the network (e.g. cluster management, interest groups), temporary forms of cooperation perform a significant proportion of the management tasks in the network (e.g. bilateral research cooperation, initiatives for a common quality management, standardization) [10].

These temporary cooperation units are initiated, because of a specific need that occurs within the value creation process (e.g. technological innovations of the external environment of the system offer potentials for further development of the common value creation process). This specific demand of the process affects different operations of the value chain. Thus, a single actor is not able to address this demand on its own, because all the affected operations need to be taken into account. The temporary cooperation units develop outside of the organizational structures of the actors of the network (see Fig. 2 – actor B and C initiating a temporary cooperation unit). The actors of the network provide the cooperation units with necessary resources (staff, funding, equipment). This includes especially bringing knowledge carriers and knowledge resources together. The results of the temporary cooperation are continuously

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transferred back and being implemented by the participating actors into the operations of the value creation process [10]. Subsystems 3 – 5 continuously synchronize according to the viable system model [24], [25]. This means that system 3 coordinates the common value creation process considering the joint strategy of the network (system 4). The strategy and the further development of the network follow the defined objectives and the business model of the network (System 5). Thus, the cooperation activities, which fulfil different management tasks (System 3 – 5) within the network, have to synchronize their work consistently. This enables permanent management institutions of the network and temporary cooperation units to coordinate their work and to fulfil the tasks of the subsystems 3 – 5 in the network from an integrated point of view (see Fig. 3).

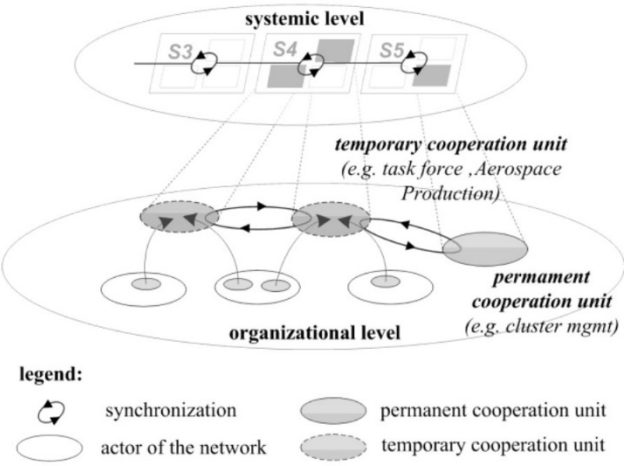

FIG 3: Synchronization between the different cooperation units within the network

These abstract explanations can be described more clearly using an example. As part of the evaluation of the project ‘Development of a Knowledge Management System for the Aeronautical Cluster in Hamburg’, the inter-organizational task force ‘Aerospace Production’ has been accompanied by the research team. This task force consists of heterogeneous representatives of the aviation industry (e.g. Airbus, Lufthansa technics) as well as from related scientific research fields. The actors’ intention is to develop innovations in the field of manufacturing in the aviation industry together. The goal of the task force is to align the academic research stronger on the demands of the local and regional industry and to identify and use synergies between the research activities of the local universities and research institutions. This task force represents a temporary cooperation unit in the cluster. The actors of Aerospace Production identify and develop innovations in cooperation to improve the manufacturing and maintenance processes of the common value chain. This corresponds with the task of subsystem 4 to identify and develop innovation potentials for the systems primary activities (see Fig.2). Of course, it is not primarily the goal of this task force to fulfil strategic management tasks for the cluster, but rather to develop their own sections of the value chain further. However the affected value chain sections of the participating actors are related to each other and have thematic aspects in common. That is why the actors of Aerospace Production perform this task in collaboration and share their knowledge about the affected sections of the common value chain and the environmental influences. Finally they perform strategic management tasks within the cluster. According to the VSM the subsystems of a viable system need to synchronize continuously. Thus the task force Aerospace Production needs to coordinate its work with other cooperation activities in the cluster, which also fulfil management tasks. It has to exchange with other research activities in the cluster on the

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subject of production in aviation. Furthermore it should coordinate with the cluster management in order to take the cluster strategy and common rules for cooperation in the cluster into account (see Fig. 3).

3) Cooperation capability – Future key resource of industrial value creation

These propositions for the functioning of an interconnected and open value creation show that the actors of a value creation network have to cooperate intensely to control the value chain together. Thus, the actors' ability to cooperate is the basis for the coordination, changeability and cohesion of the network [16], [27], [29]:

(a) The actors of the network must be capable to take on management roles within temporary and institutionalized cooperation units (realizing the tasks of the subsystems 3-5).

(b) The various cooperation units within the network must be enabled to coordinate their work in order to perform the management functions in a common procedure (synchronizing the subsystems 3-5).

The cooperation capability is highly dependent on the handling of knowledge resources in the network [30]–[32]. Inter-organizational knowledge management supports the actors of a network to perform the knowledge tasks efficiently (e.g. knowledge identification, knowledge distribution, knowledge development) [33]. This is an important requirement for their cooperation capability. For this purpose, the knowledge management system (KMS) of a value creation network must fulfill the following tasks:

1) The KMS must increase transparency for the value creation process and the relevant knowledge resources and specialists (knowledge identification)

2) The KMS supports bringing knowledge resources and specialist together in order to face the demand of the common value creation process (knowledge distribution, knowledge development)

3) The KMS must increase transparency for the cooperation activities taking on management roles within the network

4) The dual value of knowledge for an interconnected and open value creation

Dealing with knowledge resources is an extremely critical field of action in value creation networks. This is because knowledge has got a dual value in the field of inter- organizational cooperation. This can be illustrated using the categories of process knowledge and metaprocess knowledge:

Process knowledge includes the knowledge of an actor, which is necessary to perform its specific part of the value chain in the network (primary activity). It serves the operational realization of the process. The individual areas of process knowledge have different levels of relevance to com- petition for the actor. The actor aims at protecting these areas of his process knowledge with a high relevance to competition. This knowledge is part of its core competence and enables him to realize the process competitively [13], [34].

Meta-process knowledge does not support the realization of the primary value creating activities but the integration of these activities to a viable value creation process. Accordingly,

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meta-process knowledge is necessary to coordinate the primary value creation activities in the network, to further develop the process in relation to the dynamic environment changes and to ensure its cohesion [27], [32]. The actors of the network develop meta-process knowledge during their collaborations. Process knowledge of the actors, which is related to other operations of the inter-organizational value chain, is the basis of developing meta-process knowledge (see Fig. 4, area 1 of the process knowledge). Thus, an efficient realization of the management tasks in the network by the actors directly depends on the availability of process knowledge, which is relevant for the cooperation. Furthermore knowledge of the relevant environment of the value creation network is a basis of developing meta-process knowledge (see Fig. 4).

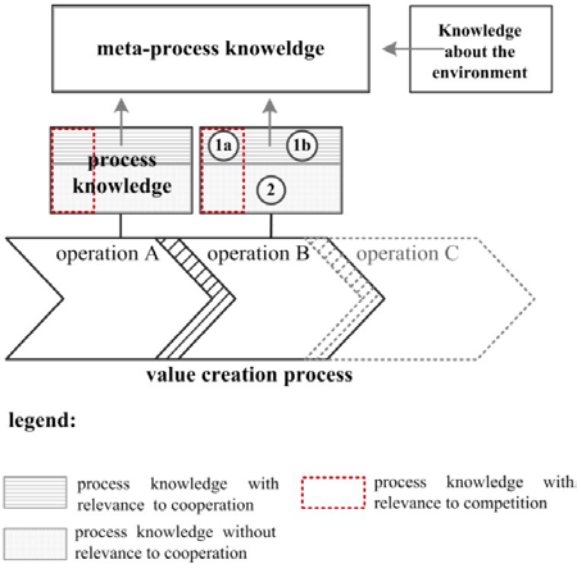

FIG 4: Inputs of meta-process knowledge

However, some areas of process knowledge are important for the actors' ability to compete (see Fig. 4, red mark). The sector (1a) of Fig 4 represents these areas of the actors' process knowledge, which are relevant for the cooperation and have a high relevance to competition [34]. Actors are holding back knowledge that is considered to be highly competitive, because it is part of the actors' core competencies. This knowledge has got a high value for the single actor [14]. However, the cooperation capability is strongly dependent on the availability of this kind of knowledge resources along the common value creation process. Thus, this knowledge has got a high value for the success of the whole value creation network. This dual value of knowledge is causing the already mentioned conflict.

5) The handling of knowledge within the regional aeronautical clustering Hamburg aviation

The studies in the field of the aeronautical cluster in Ham- burg show that the participating actors consciously avoid to create transparency and to make process knowledge available, which is relevant for cooperation in the network (see Fig. 4, area (1) of process knowledge).

The actors pursue this strategy to prevent an inadvertent knowledge drain and to minimize the risk of imitation by competitors. This means that the necessary knowledge resources of the network are locked inside the different organizations barriers. However, the actors of the cluster are holding back not only relevant competitive knowledge, but also knowledge of minor or less relevance to competition.

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Through holding back their knowledge to save their own competitiveness, the competitiveness of the network is weakened, since knowledge relevant for coordination is not avail- able. The ability to coordinate value creation processes in the network and to further develop them is, therefore, limited.

The competitiveness of the individual actor interacts closely, however, with the competitiveness of the value creation net- works in which it operates (see Fig. 5) [5], [35]. Apparently, actors are not sufficiently aware of this interconnection.

The design of structures and management of processes in the field of industrial manufacturing is still mostly based on traditional business principles of decision making. These principles are based on an internal point of view of the company. Thus, across all industries networking is promoted, but the companies open their structures and processes rather reluctantly [3].

However, if future value creation networks are able to develop and improve their cooperation capability using innovative methods in inter-organizational cooperation, then the potentials of an interconnected and open value creation will be unfold in these networks. Companies operating in such interconnected and open networks will benefit from the added value of the whole network and will gain competitive advantage over firms operating according to the traditional model of the closed factory [2], [5], [35].

The actors of Hamburg Aviation must face these challenges and turn them into opportunities. They need to develop their cooperation abilities further. The design of a common knowledge management system is needed, which makes the knowledge that is relevant for the cooperation available along the whole value creation process and protects the actors' knowledge with a high relevance to competition.

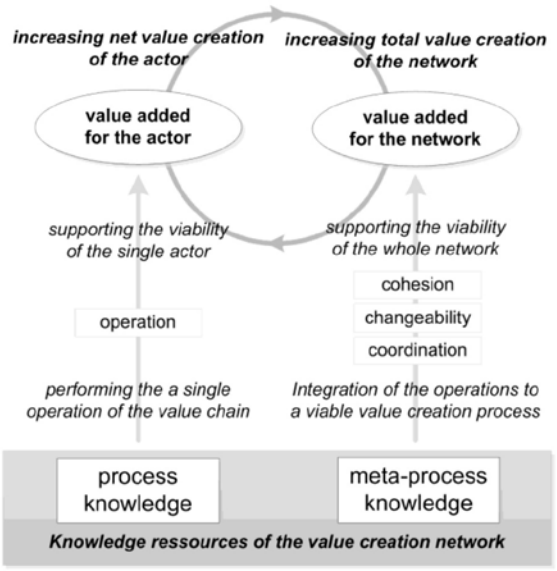

FIG 5: Interdependencies between the success of the single actor and the whole network

6) Knowledge management within the Hamburg aviation cluster

Based on these studies within the aeronautical cluster in Hamburg the Hamburg Model of Knowledge Management (HMKM) has been developed. The HMKM is an integrative model for the design and implementation of knowledge management systems which focuses on the inter-organizational co-operation [36]. In the following only these parts of the model are explained in

detail focusing the conflict between the availability of knowledge within the network and the protection of Intellectual Property.

6.1) Protected and open levels of inter-organizational cooperation

According to the HMKM two levels of cooperation have to be considered developing a knowledge management system for Hamburg Aviation: The protected and open cooperation level [37].

The protected level offers secure workspaces to every cooperation activity within the network. The actors of a temporary or permanent cooperation unit of the network are able to share their process knowledge, which is needed to cooperate and to solve their common task within their secure workspace. The process knowledge of the actors, which is relevant to competition, is protected by the workspace.

The workspace is equipped with standardized inputs and outputs (see Fig. 6). Input A and output B of the workspace are the interfaces between the individual primary activities (primary value creation process of the network) and the workspace. The function of Input A (see Fig. 6, Input A) is to filter the knowledge resources, which are transferred from the actors (process knowledge about the primary activities) into the workspace. The workspace is only equipped with those resources of process knowledge of the involved actors, which are needed to solve the common task (knowledge filter).

The actors transfer the common results back to their own organization via Output B and implement the knowledge, which was developed during the cooperation, into their own processes (see Fig. 6, Output B).

Output C and input D of the workspace provide the interfaces between the protected and open cooperation level. The open level of cooperation allows the coordination of independently working cooperation units in the network (synchronization of System 3 – 5), so that the individual activities perform the tasks for the control of the network in a common context (see Fig. 3). In order to achieve this the open level allows the distribution of meta-process knowledge between the different cooperation units of the network.

The meta-process knowledge, which is developed during the cooperation in the workspace, is transferred via output C from the different workspaces of the protected cooperation level to the open level of cooperation (see Fig. 6, output C of workspace). The meta-process knowledge is abstracted by Output C prior transferring to the open level. This prevents conclusions about the competition-related knowledge of the actors, which has been exchanged within the protected workspace. Thus there is no danger of exchange of process knowledge, which has got a high relevance to competition for single actors, at the open level of cooperation.

The meta-process knowledge, which is available at the open level of cooperation, will be retrieved by the workspaces depending on the specific tasks (see Fig. 6, input D of the workspace).

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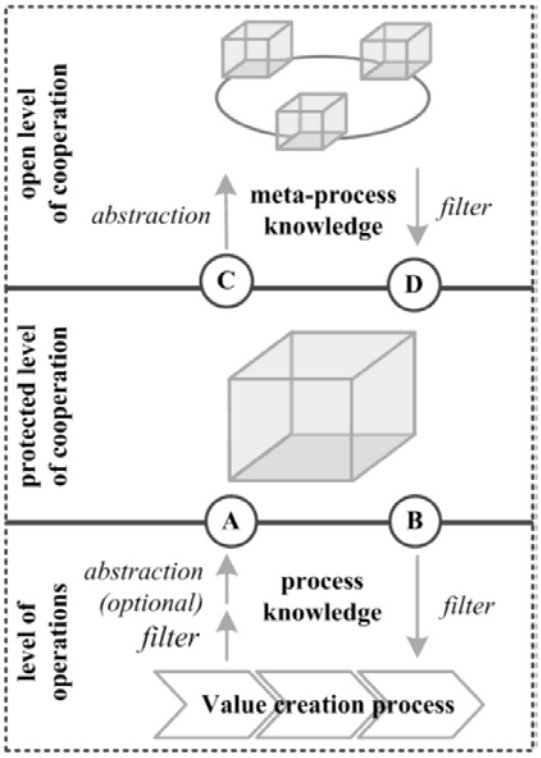

FIG 6: Interrelations between the protected and open level of cooperation within a value creation network

6.2) Design principles for protected workspaces

The protected workspaces need to ensure the internal availability of knowledge, which is relevant for the cooperation and to solve the common task. Furthermore, the knowledge resources of the actors have to be protected against the following scenarios:

- Opportunistic behavior of actors within the protected workspace
- Unintended outflow of knowledge to external actors

The workspace should not be understood as a virtual collaboration system or a forum for meeting and talking. Rather, it includes all the structures and processes of cooperation. The design of the workspace is based on the principles of integration and openness to address the conflict between the protection of intellectual property and the availability of knowledge. This aims to avoid restrictive courses of action, which set up internal barriers and prevent internal cooperation processes from opening [37].

Structures and processes of the working space need to avoid traditional cooperative behavior, which is characterized by a strict classification of relational structures (supplier and buyer) bilateral exchange relationships, one-way flow of information and goods as well as profound power asymmetries between the actors.

Instead, the workspace promotes forms of cooperation, which are characterized by a broad and intense interaction of the participating actors. The individual cooperation activities in the network are no longer considered as a cooperation of stakeholders from different organizations of the network, but the actors within a protected workspace build up new business units within the value

creation network [2].

The framework of the workspace is the common business model of the participating actors, which is based on jointly defined objectives. According to this business model, the actors offer solutions to the demand of the value creation process in the network and they are jointly responsible for the realization and working of the solution. The expected returns need to be calculated by the actors. In relation to the provided resources and the performed function during the cooperation the pro rata earning has to be determined for each actor. The actual achieved value for each actor during the cooperation need to be evaluated and is presented transparently in the workspace. To summarize this the workspace needs to combine two key aspects:

- The cooperation of the actors is based on an attractive business model, which affords best guarantee for a good return to the participating actors [36]
- The actors need to collaborate in joint business units to achieve the common goals

This combination of the expected added value for each participant as well as the dependencies between the actors in relation to the achievement of this goal establishes a framework for internal openness (availability of knowledge) and minimizing opportunistic behavior within the group (protection of competitive knowledge) [26], [36].

6.3) Design principles for an open level of cooperation

The open level of cooperation makes meta-process knowledge available across the value creation network using defined standards. These standards describe the form of knowledge that has to be exchanged between the workspaces. Further- more, the knowledge contents, which need to be exchanged at the open level, are specified. These standards influence the work of the cooperating actors within the workspaces, as well as the configuration of the inputs and outputs of the workspaces [10], [37]. It has already explained that the meta- process knowledge, which is developed within the protected workspaces, need to be abstracted prior transferring to the open level in order to protect the competitive knowledge of the actors (see. 7.1). As a consequence it cannot be ruled out that meta-process knowledge, which is available at the open level, is always sufficient for a targeted coordination of individual activities in the network, which are carried out in separate workspaces. If this is the case, additional protected workspaces must be opened by the actors of the concerned activities in the network in order to coordinate their work at the protected level.

7) Conclusion and outlook

The cooperation capability of the actors within a value creation network is becoming increasingly important and determines the competitiveness of the network and the individual actors. An efficient use of the knowledge resources within the network is a central condition for developing abilities to cooperate. However, the establishment of an inter-organizational knowledge management system is a very complex task. An important success factor of the knowledge management system is to protect the knowledge of the actors while at the same time ensuring the availability of knowledge within the network.

Using internal safety barriers is not an appropriate strategy to face this conflict. Rather, the integration of the actors during the cooperation and the gradual opening of cooperation structures and processes should be encouraged. However, this will be a challenging task for

the single actor and the community of the network.

First, the needs of the common value creation process must be transparent. On this basis the needs of the process can be identified and innovative actors of the network are able to develop new business models in order to face these demands. These business models operate at the interfaces and on the meta-level of the primary value creation process and offer great potential to improve the holistic value creation of the network.

The single actor needs to recognize the importance of these new business units, because of the expected return for the network. The net value creation of the actor is very much dependent on the value creation of the whole network. By recognizing this, the actor has an incentive to invest in these emerging business units of the network. The knowledge of the participating actors on the value creation process in the network is the main resource of these business units. Thus, these knowledge resources are the investment of the participating actors. Accordingly, new systems of remuneration for the knowledge-investment of the actors must be provided.

Future research should therefore focus on the design of structures, processes and the underlying business models of these new forms of cooperation. It is necessary to develop innovative forms of inter-organizational cooperation promoting the integration and gradual opening of the actors within the value creation network and increasing the dependencies between the collaborating actors.

However, further studies should not only focus on the issue of cooperation within value creation networks but consider the organizations within the network (the actors). How does the single organization in the network need to change its structures, processes and culture in order to realize the potentials of an interconnected and open value creation and to be able to take part in such value creation processes?

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