

Openness and Trust in Value Co-Creation: Inter-Organizational Knowledge Transfer and New Business Models

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Abstract--The on-going paradigm shift from industrial production to value co-creation increases the importance of openness as a central competitive factor. From a systemic point of view, this means that external and internal interfaces within the value creation system need to be created in a way that knowledge can be exchanged more efficiently. However, openness in inter-organizational settings is often blocked by a lack of trust. Hence, concepts are needed to manage trust with regard to varying context-depending degrees of openness. The conceptual framework of this interpretive study is based on the theory of openness, which describes the dependency of the success of networks on the incidence of emergence. The developed concept of trust circles is based on empirical data selected from the aeronautical cluster Hamburg Aviation. It serves to identify circles of trust within the system and activate their potential to enable inter-organizational knowledge flows and new joint ventures.

I. INTRODUCTION

The increasing number and economic importance of production networks is one sign of the on-going paradigm shift from industrial production to value co-creation. Synergy and emergence become central aims of value co-creation, because they result in competitive advantages by utilizing previously not exploited resources. The most valuable resource is the pool of very heterogeneous specialized knowledge. This knowledge has to be shared to foster effects of emergence and synergy. Simultaneously, it has to be protected against outsiders in order to ensure the competitiveness of the overall system and its actors. In other words, the cooperation in inter-organizational settings such as industrial clusters is characterized by a permanent oscillation between the extremes of openness and closeness. Openness and knowledge transfer are, however, in most cases blocked through a lack of trust. The conceptual framework of this interpretive study is based on the theory of openness, which describes the dependency of the success of networks on the incidence of emergence. The developed concept of trust circles is based on empirical data selected from the aeronautical cluster *Hamburg Aviation* and serves to identify circles of trust of different intensity. They can be used as an initial point for optimizing the harmonization of value chains as well as fostering the innovative capacity of the whole value creation system.

A. Bibliometric analysis

To give a first hint on the relevance of the topic, the authors performed a bibliometric analysis of scientific

publications in the “Web of Science”-database (Thomson's ISI Web of Knowledge). Referring to the considered categories¹, 2.352.273 articles have been recorded with an average annual growth rate of more than 5 % between the years 1995-2013. This rate is used to standardize the following analysis of the specific topics of openness, trust and networks. In the next step, all publications addressing “openness” or “networks” or “trust” in some way were counted based on various search term combinations². 9.543 entries were addressing “production networks” and “clusters”, 61.812 articles were containing the word “open”, 9.623 the word “trust” within the topic. A number of 336 articles comprised both “openness”- and “network”-terms. 124 articles comprised “trust” and “network”-terms.

The number of annually published articles in the database grows continuously. A trend in a specific subject can only be derived, when it is normalized compared to the general development. For this, all values were standardized to the respective value in 1995, which was set at 100%. Only the deviations of the development of the specific-subject matter compared to the general record development is considered in the following.

After the standardization with the overall growth an increasing use of the terms open (164%), trust (443%), networks (299%) within scientific publications can be observed. A trend can also be stated regarding the development of contributions that address both openness and networks as well as both trust and networks. Here, the authors found an increase up to 282% and 456 % in the latter within the observation period (cf. Fig. 1).

Despite reasonable criticism of the bibliometric method and the incompleteness of the database, these figures lead to the conclusion that these issues attracted disproportionately high attention by researchers in recent years³. This indicates that the understanding of the relationship of openness and trust is essential to the management of networks. In the following sections, first the concepts of openness, trust and networks are explained in detail.

¹ “operations research management”, “economics”, “management”, “engineering”, “business”

² “regional cluster”, “business cluster”, “industrial cluster”, “industry cluster”, “production network”, “open” and “trust”

³ In comparison, other terms record a downward trend (eg. “Six Sigma” with peak in 2009).

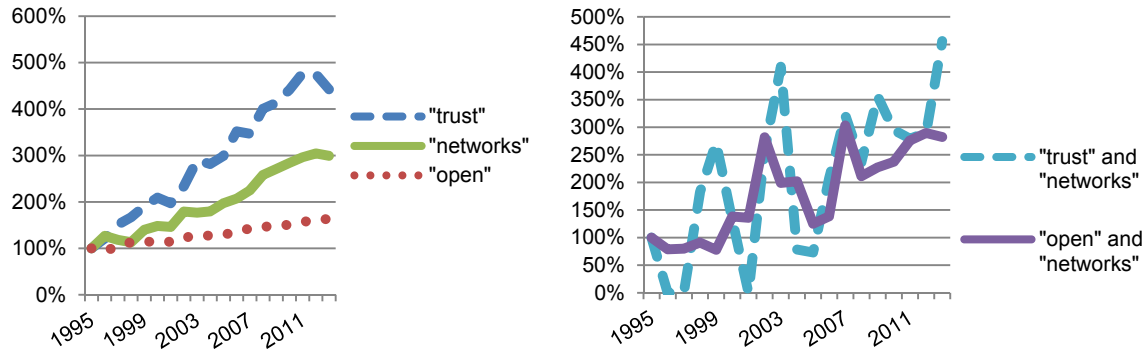


Fig. 1: Bibliometric analysis of the terms openness, trust and networks and their co-occurrence in scientific publications

B. Openness

The increasing importance of the abstract concept of “openness” can be observed in particular in the areas of innovation, R&D and technology management. The open innovation approach [5] has notably promoted this development. The scientific discussion on open innovation focuses on the effects of openness on innovation capability. Openness in terms of open innovation can be examined with respect to different levels of analysis [57] (individual, enterprise, area etc.). Mostly, however, the enterprise-level becomes the object of analysis and in general the permeability of the corporate boundary is concerned in terms of knowledge, resources and personnel [7]. LAURSEN and SALTER examine openness as related to the number and use of external resources [19]. Another perspective for viewing the permeability of organizational boundaries as a manifestation of openness is the inter-organizational knowledge management [16,17]. LICHTENTHALER describes inbound and outbound transfer of knowledge [7] and the need for a dynamic management of knowledge in inter-organizational systems, without necessarily internalizing it [21].

In terms of the value creation taxonomy proposed in this paper a comprehensively concept of openness is developed. It encompasses a predominant conceptual framework for identification, description, analysis and configuration of structures, processes and actor relationships in value creation systems [39].

C. Trust

In economics there is no specific “theory of trust” although any economic relationship is actually based on trust and implies certain norms of reciprocity. However, trust is an interdisciplinary research topic, which is investigated on three different levels: the individual, the group and the system [3,38].

Considering trust as the result of a subjective-rational calculation, the decision to trust another person is associated with an ambiguous outcome. The trustor is always taking a risk. After all, a leap of faith might be disappointed [29,45]. Therefore, risk and uncertainty always play a role in trust

situations [22,32,46]. The higher or more intense the trust, the higher the risk one is likely to take. Interpersonal trust always implies the expectation of an intangible equivalent value [32]; it can therefore be referred to as a reliance on reciprocity.

On a more abstract level, systemic trust means to have trust in norms, values and behaviors defined by systems such as organizations or institutions (e.g. the monetary system or the transport system) [6]. The expected equivalent value in case of the impersonal (often referred to as “face-independent”) systemic trust is more abstract [11,42]. It is trust in the functionality of a system and its norms. In the case of a value creation system, the systemic trust would correspond to the trust in the fulfillment of its purpose (i.e. creating new value, e.g. producing an airplane). In the sense of LUHMANN systemic trust serves the reduction of social complexity, since no individual is able to process all the information available [3,23]. Systems and organizations are, however, generally represented by people (e.g. officials, managers, politicians). Thus, systemic trust implies also a personal component. According to SCHWEER both trust components are mutually dependent, because systemic trust is essentially the result of the experiences with trusted representatives of the system [45]. In order to assess the trustworthiness of a person or organization people refer to experiential knowledge they have gained during previous interactions. A trustor needs information about the trustee in order to be able to trust [23,32]. In other words, if the trustor had complete information, he would not need to trust at all [9]. The assessment of the trustworthiness of a system, just like that of a person, depends on the particular experiences concerning the interaction with the system and the associated risk with regard to future interactions and their expected outcomes.

The central role of (experiential) knowledge in terms of interpersonal trust becomes evident in the model of LEWICKI & WIETHOFF [20], in which the development of trust is divided into three stages. In the first stage of the calculus-based trust partners try to calculate the risk of co-operation without knowing each other. It is therefore also referred to as “fake-“ or “non-trust”. In the second stage of the knowledge-based trust mutual experiences and

information are available. Within this stage the trust expectation implies competence-, integrity- and benevolence expectancy (reciprocal behavior). In the last stage of the identity-based trust, the partners share common values and standards that foster the groups social cohesion [3,20]. Finally, we consider distrust not as the simple absence of trust [20,23], but as a coexisting phenomenon that can feature productive aspects, if they are institutionalized (e.g. protection against excessive group cohesion that renders an independent decision making impossible, monitoring of processes etc.).

1) Functional Aspects of different types of trust from a systemic perspective

The level of identity-based trust as well as systemic trust are the basis for social cohesion and therefore, of central importance for the viability of long-term inter-organizational relations in value creation systems (e.g. industrial clusters) [2,3,30]. With regard to the initiation of new projects and joint ventures, trust in interpersonal relations can activate the capital character of social capital and foster the width and depth of cooperative activities. With regard to the whole value creation system, systemic and identity-based trust ensure its viability through common norms and standards that facilitate its fulfillment of purpose. In Fig. 2 the presented types of trust are assigned to a specific system function they fulfill in the context of an abstract value creation system. The motivation for cooperation and an open knowledge transfer directly depends on the level of trust between the actors.

Type of trust	Level	System function
Calculus-based trust	trustor/ trustee	sensitive social capital, nucleus for common projects and business models
Knowledge-based trust		
Identity-based trust	group	social capital; cohesion, identification with common values and norms
Systemic trust	systemic- interactionist context	reduction of complexity, psychological risk minimization, normative guidance, barrier-free communication, free information flow
Distrust	systemic- interactionist context	protection against excessive group cohesion, ensuring independent decision making, monitoring of processes

Fig. 2: Functional aspects of different types of trust

D. Networks

The aim of cooperation with other companies within value co-creation systems such as production networks or clusters is the realization of larger overall revenue by realizing common efficiency gains, synergies, coordination and emergence [61] that may also improve the individual performance and competitive position [49]. Cooperation in networks and clusters is based on viable structures and principles that have to be established, maintained, and may have to be adjusted to occurring changes [39,40]. A number of scientific papers have discussed the effective design and management of production networks and network practices [4,18,26] as well as specific elements of openness such as changeability [55,58] and complexity [8]. A fundamental and comprehensive examination of openness from a general point

of view of production networks does not occur. However, it is essential for the maintenance of the viability of a network.

II. CHANGING PATTERNS OF VALUE CREATION

The basis for the following analysis is a value creation taxonomy, which includes the structures, processes and the object of value creation [35,39]. These three central elements are subject to lasting changes, the cause of which can in turn be found in technological change. Key criteria are further developments and spread of information and communication technologies (I&C technologies) as well as production technology (see Fig. 3).

The transformation of value creation structures can firstly be attributed to globalization [10,56,58]. The spread of I&C technologies and the accompanying fall in transaction costs means that the benefits of widely dislocated value creation activities are increasing, which is followed by permanently changing relations between the worldwide operating actors. However, as the pressure of competition increases, this is also accompanied by a potential expansion of sales opportunities. Secondly, an increase in the importance of the customer's role can be detected. Since knowledge work is gaining importance as part of value creation processes, customer's power over the producer is rising due to a better access to I&C technology and networks. Therefore, the value creation and production cannot longer be seen within the boundaries of a company. It is no longer possible to achieve a clear demarcation between the domains of customers and producers ('prosumer') and, accordingly, the role of traditional companies is changing [33,50].

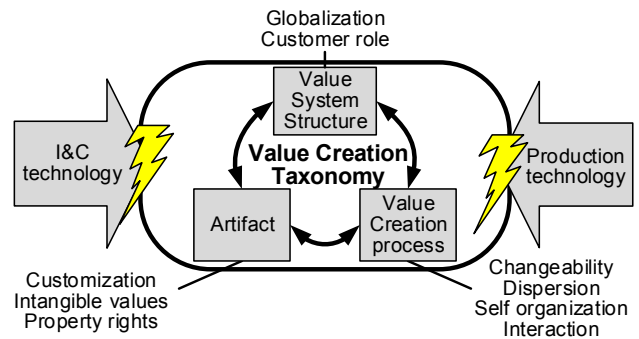


Fig. 3: Value creation taxonomy [39]

The transformation of the value creation processes directly stems from the influence of the value creation structure. The need for individualized products and globalization thus calls for changeable production systems and processes. In addition, the number of actors involved in the value creation process is increasing. Coordination of these actors takes place less through hierarchical organizations: With the decreasing importance of conditions of time and space, the value creation processes are increasingly based on interaction, collaboration and self-organization [43] of the worldwide distributed actors to cope with the increasing complexity.

Concerning the value creation artifact, three essential aspects of change can be identified. Firstly, customers are increasingly demanding individualized products and services. This involves an additional challenge for the manufacturer. Secondly, the ratio of intangible components of the product is rising in proportion to tangible components, which among other factors can be attributed to the increasing importance of software and service components. The third aspect is closely linked to the second. Here, the issue concerns the property rights constellation of the value creation artifact. While the benefits of regulated exclusive property rights are accepted for physical goods, this acceptance requires a revaluation in the case of goods with an increasing intangible or informational character [39].

A. Bottom-up economics

The transformation in the three core areas of value creation taxonomy is leading to new patterns of value creation, which can be summed up under the term 'bottom-up economics'. It differs essentially in its structure-related and process-related character from traditional industrial production, which represents a manifestation of top-down economics.

Bottom-up economics is characterized by a fusing of production and consumption, by distributed structures and processes and by collaboration as the most intensive form of interaction between actors [52]. In all areas of value creation, such as research and development (e.g. user innovation, open innovation), production (e.g. crowdsourcing, production networks [44], mass customization [34,44], collaborative engineering [24]) and marketing (social commerce, viral marketing, collaborative filtering), signs of this paradigm change can be found. Essential features of bottom-up economics in relation to the underlying value creation model, organization and production structures will be explained in the following subsections. UEDA et al. describe the transformation in value creation using three value creation models [53]. While the providing value model is appropriate for describing forms of industrial production, the adaptive value model is better suited to describe the current state of production. However, an increase of the importance of the co-creative value model can be expected in the future (see Fig. 4).

While the problems that occur in the providing value model may be regarded as optimization problems, the adaptive value type of model can be used to consider problems that may be regarded as adaptation problems. However, in the co-creative value model, the values for producer and customer cannot be independently determined from one another. Furthermore, poor predictability of the environmental behavior and of the motivation and demands of customers is assumed. A large number of the value creation patterns under observation (e.g. collaboration of producer and customer, user innovation, allowing access to product data) can be better explained by the co-creative model than by the previously described models.

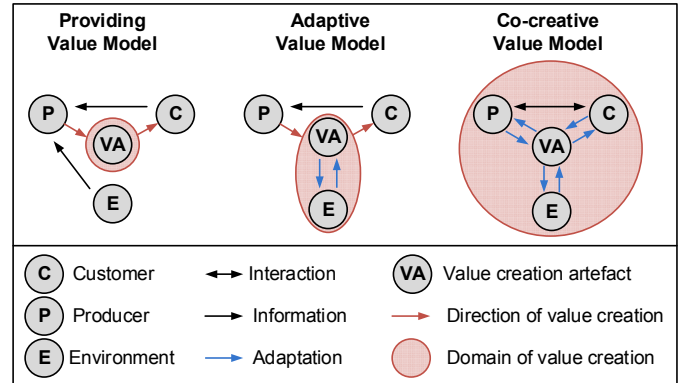


Fig. 4: From providing to co-creative value model [53]

Classical industrial organization is geared towards the central idea of mass production. However, mass production can only be regarded as an ideal model under certain conditions. These include uniform production independent of external influences, which in turn calls for homogeneous mass markets in the long term and a stable demand. The transition to the information age has, however, promoted the removal of these assumptions. The concept of interactive strategy represents the starting point for the scientific discussion concerning interactive value creation, which results in a re-evaluation of the relationships between the actors involved in value creation [31]. Together with the application of modern production principles [27] it forms an integrating strategic approach for the design of future value creation systems that correspond to the present and future requirements. Increasing individualization and the discontinuous demand behavior associated with it, as well as the increase in complexity of expected services represent new challenges for manufacturers. Such challenges can only be managed through structural and strategic changeability, an extension of the range of services and intensified cooperation. The reality resulting from the transformation described can no longer be managed precisely with the existing "closed" understanding of value creation in production systems as the prerequisites of the logic of mass production have become obsolete in many cases. The consequence is the need for a redefinition of the object under consideration, namely that of production sciences, which takes the premises of a changeable, open value creation into account.

B. Theory of Openness

According to the presented study, openness is interpreted in terms of systems theory and cybernetics [25,39]. Consequently, it concerns one of two system conditions. In contrast to a closed system, an open system is distinguished by the fact that at least one of its elements is involved in interactions with elements of another system. As organized social systems are always in interactive relationships with surrounding systems, they can be viewed as open systems as a matter of principle. In the past, for reasons of simplification companies and production systems were considered as closed systems. Through changes in the environment, the

requirement for openness is increasing and no longer remains negligible. Openness is therefore not a completely new feature, but an inherent system property that is becoming increasingly relevant. In this sense, openness describes the ability for interaction with other elements and at the same time it is a prerequisite for the long-term viability of systems [39].

The spread of I&C technology as well as production technology and the accompanying networking together with the increasing interaction potential demand a strategic, structural and procedural opening in form of interactive value creation [51]. This is synonymous to the claim that “networking” and “openness” are complementary strategies. If this corresponds with reality, the result for companies is that a rational approach demands a change of the two activities at the same time and in the same direction. However, as the increased networking that delivers the growing potential for interaction is an exogenous influence, the only logical consequence for companies would be to pursue more intensively a strategy of openness [30,39].

1) Openness in the context of value creation

The theory of openness is derived from the observation that among the currently prevailing conditions in the business world, more open approaches to the configuration of value creation are acquiring greater importance than the more closed approaches [39]. Here, the spheres of influence of value creation systems can be subdivided related to the notions of the value creation taxonomy into the categories of value creation structure, architecture of the value creation artifact and value creation process (cf. Fig. 5) [39]. For each of these spheres we identified indicators that characterize the level of openness or closeness of a system [39].

		Indicator	Closeness		Openness
 Architecture of the value creation artifact	Structure	Granularity	Coarse		Fine
		Modularity	Low		High
	Function	Property rights	Private goods		Public goods
		Type of service	Product or service	Product-service Systems	Co-creation experience
 Value creation process	Value creation activity	„Width“ of Co-activity	Low (bilateral)		High (mass...)
		„Depth“ of Co-activity	Coordination (integration)	Cooperation (participation)	Collaboration (interaction)
	Value creation strategy	Competitive strategy	Competition	Cooperation	Cooperation
		Competitive advantage	Unique		Hybrid
 Value system structure	Intra-organizational	Business model	Closed source	Partial de-commercialization	Open Source
		Communication culture	Low	Participatory	Reflexive
		Organizational structure	Hierarchic		Heterarchical; Adhocratic
		Configuration	Monolithic		Modular, fractal
	Inter-organizational	Changeability	Low		High
		Interorgan. coordination	Hierarchic	Hybrid	Market
		Networking	Bilateral cooperation		Virtual network
		Role dynamics	Static	Flexible	Dynamic

Fig. 5: Openness in value creation⁴

⁴ For further details and the related literature review according to the taxonomy please view [39].

2) Openness of the structure of the value creation system

Two aspects are considered with respect to the openness of the structure of value creation systems. Firstly, it is necessary to examine the relationship between the system and its environment, which means: defining the system's position to its surrounding systems and the permeability of the system's boundary [2]. Secondly, the inner structure of the systems can be investigated in terms of whether they meet the requirements of openness [28,47]. Consequently, the investigated driving forces are differentiated into the spheres of influence of intra-organizational and inter-organizational openness [39,60].

3) Openness of the architecture of the value creation artifact

In addition to the structure, the object of value creation itself, the value creation artifact, has the potential to be designed in an “open” manner. As an artificial system, an artifact differs from a natural system in a way that it has been consciously created by humans for a specific purpose. Correspondingly, a value creation artifact is the result of a value creation process. It is always a combination of tangible and intangible constituents [48]. The architecture of such an object extends over the spheres of influence of structure and function [31]. While the structure, which can in turn be classified as property rights constellation and physical structure, tends to be regarded as the means to an end, the function tends to be linked with the actual defining purpose. The property rights constellation assumes a key role in the design of the value creation artifact. It is decisive for the opening of the value creation process [39].

4) Openness of the value creation process

The degree of openness in the value creation process is determined by value creation strategies and activities of the actors [35]. Open value creation strategies focus customers' benefits by means of an individualized offer [54]. Openness aims in this context at exploiting synergies by virtue of cooperation with other actors and allows at least partial decommercialization of traditional business areas in order to be able to achieve competitive advantages, which can be monetized in other “new” areas [7,14,33]. Co-activity shapes the openness of the value creation process and includes all the co-actions between actors aimed at maximizing value creation [39].

Open structures and processes that cope with the changing patterns of value creation always require for a certain amount of interpersonal as well as systemic trust and well accepted norms of reciprocity. Depending on the type of network (R&D, buyer-supplier, production networks, horizontal and vertical network constellations etc.) and the architecture of the value creation artifact, different levels of openness can evolve and related to that, different levels of systemic and/or interpersonal trust are needed [39].

III. CIRCLES OF TRUST IN VALUE CREATION NETWORKS

A. The hidden potential of social capital

According to the resource-based view competitive advantage comes from strategically valuable resources that can be material as well as immaterial. These resources need to be identified, as they are essential for the viability of a company [1]. Formal and informal networks are considered as a form of social capital (active relationships that are able to expand the scope of actions) and thus as a valuable resource [13,37]. However, the potential of social capital in production networks often remains inactive as competitively sensitive resource [13,37]. Therefore, a central super-ordinated management task is to support emergence and synergy based on managing the inter-organizational knowledge flows between the heterogeneous actors and activating the potential of already existing formal and informal networks. There exist many situations where the transfer, diffusion or generation of knowledge is prevented by concerns of losing competitive knowledge or simply the lack of effective interfaces for exchange. In order to achieve the rather contradictory aims of protecting intellectual property as well as profiting from emergence and synergy a permanent oscillation between the extremes of openness and closeness (resp. exclusion and inclusion) is necessary.

The network structures of a cluster consist of multiple relationships and network configurations whose potential need to be recognized and developed. Furthermore, individual actors have ties in different network types and relationship constellations, which influence their actions additionally. The question is: how can the potential of the different social network types within the cluster be activated in a way that the permeability of the institutional boundaries increases and knowledge can be exchanged more effectively? The answer to this question might also lead to a deeper understanding of the interrelation between trust, openness and the modeling of interfaces within the value creation system structure in inter-organizational networks.

B. The Case of the German Aeronautical Cluster Hamburg Aviation

The tradition of Hamburg's aircraft industry goes back to the year 1909 and had its heyday with the establishment of the technical base of Lufthansa in the 1950s and the Franco-German Airbus program in 1969. In the following decades, Hamburg became the world's third largest center of civil aviation industry. For the coordination of cluster activities, the association "Luftfahrtcluster Metropolregion Hamburg e.V." was founded. Currently, the cluster encompasses more than 300 SMEs, the major sites of Lufthansa and Airbus and several universities involved in research programs. More than 40,000 jobs are assigned to the Aviation Cluster [12]. As part of the development of a concept for a knowledge management system for the cluster Hamburg Aviation, semi-structured open expert interviews were conducted with senior staff, project managers and professors from the cluster in the period from August 2011 to April 2012. The survey focused on the current mode and experiences of the cooperation within the network as well as requirements and expectations for an efficient knowledge management. The data were analyzed according to the principles of Grounded Theory. Not surprisingly, trust proved to be a key category regarding the willingness of managers, entrepreneurs and researchers to exchange or to provide their internal knowledge.

C. The "situation of trust" in Hamburg Aviation

In order to identify the hidden potential of existing trust in the cluster and to illustrate the need for trust management, the current "situation of trust" in the cluster is presented based on the empirical findings from the qualitative data collection. Fig. 6 shows empirical evidences concerning factors that had a positive impact on interpersonal and/or systemic trust.

Hamburg Aviation is a network of very heterogeneous actors joining value creation processes with a high degree of autonomy, which leads to loose ties between the system elements and consequently a fairly low social cohesion of the whole system. Moreover, the horizontal interrelations among the clusters' actors are marked through competition that rather fosters distrust and nondisclosure. On the vertical level,

Sphere of influence	Empirical evidence	Interpersonal trust	Systemic trust
Interaction / Contact	personal contact (face-to-face; formal/informal)	x	
	institutionalized, regularly exchange/transfer	x	x
	information available on the interaction partner	x	
Experiential knowledge	situative/personal	x	
	situative/systemic		x
Cohesion	common vision, objectives	x	
	perception as a community	x	
	common language and communication culture	x	
	common umbrella brand/ corporate identity		x
Normative, ethical framework	formal cooperation agreements (contracts, NDAs)		x
	common codex		x
	formal rules of communication and behavior		x

Fig. 6: Trust building factors in the cluster *Hamburg Aviation*

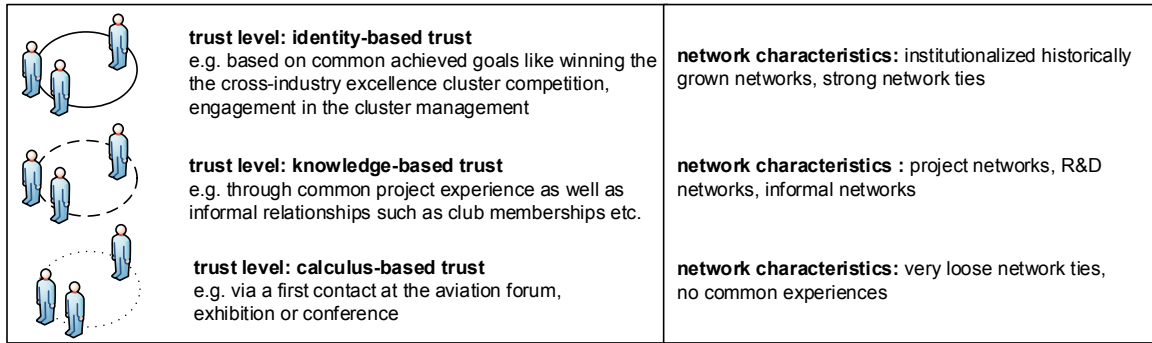


Fig. 7: Levels of interpersonal trust in the cluster

asymmetric intra- and inter-organizational links are reflecting the power relations within the cluster. First and foremost, actors focus on access, control and position in the supply chain. Additionally, a recent event seems to have strongly disturbed the established long-term economic relationships on the vertical level. When AIRBUS came to the site in 1969, it built up its value chains resp. supplier networks focusing mostly on local companies. This evolutionary emerged system based on long-term relations of trust as well as short and direct communication channels changed, however, when the system integrator AIRBUS launched a huge consolidation and restructuring of its supply chain, which had major impacts on the local SMEs. The organizational turbulences that occurred due to changing interfaces and communication channels lead to a decrease of trust in the overall system and made lots of companies search for other business fields. However, new inter-organizational institutions such as a cluster management or a center for applied aeronautical research are only some factors that can support building and rebuilding trust between the cluster's actors.

Furthermore we identified network characteristics/ types that can be also used as indicators for a certain stage of trust according to the model of LEWICKI (cf. Fig. 7) [20]. The characteristics of the stages provide the framework for the concept of circles of trust. We could observe that in the narrower "circles of trust" information and knowledge flow more freely and joint projects are initiated more often.

However, an exact determination of the levels of trust and their relation to certain network characteristics requires further quantitative studies. Since competitive advantages come from strategically valuable resources, it is important to identify them. Knowledge is recognized by all interviewees as competitively sensitive resource. In general, the provision and exchange of information and knowledge (as particularly sensitive resource) is perceived as extremely risky, the protection of intellectual property and core competencies plays a major role for all actors. This risk aversion can be attributed to a lack of trust in the whole value creation system as well as between single actors within this system. Nevertheless, most interviewees recognized that the particular trustworthiness can be better assessed; the more knowledge about each other is available (understanding of

processes, competencies and attitudes). On the other hand, a lack of trust applies as the reason for the retention of knowledge and information as well as the reluctance of future joint ventures (especially outside the R&D division). Thus, the central question is: How can the potential of the outlined circles of trust be effectively and systematically exploited? And how can such circles with a lack of trust be managed effectively?

D. Activating the potential of social capital through building circles of trust in VCNs

The identification of existing circles of trust within the system can serve as a basis for deducing new cooperative activities and joint ventures (see Fig. 8). Depending on the different processes within the cluster (fields of technology, maturity of the technologies) different legal forms of cooperation are proposed. The more intense the trust within a trust circle, the more openness can be risked and the higher is the expected synergy.

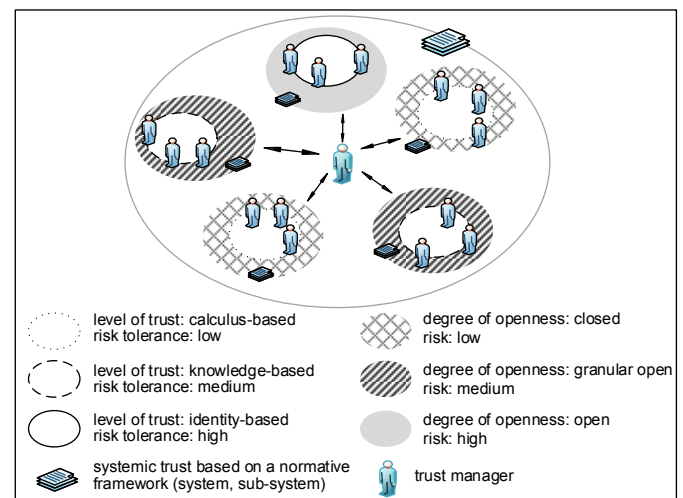


Fig. 8: Concept of trust circles

The task of managing trust should be fulfilled by a neutral person with an extended knowledge of the sector and the ability to consider inter-organizational contexts from a holistic perspective. Since this person also functions as a

representative of the whole value creation system, the interactions with him can also have an impact on the development of systemic trust. The fundamental tasks of the trust manager involve:

- identification of the trust circles and their actors
- moderation of initiating phase
- adjustment of the degree of openness
- balancing interests
- establish congruent goals and expectations
- conflict resolution

The aim is a balanced ratio of openness with regard to the demand for protecting intellectual property. In this way, an outward as well as an inward trustworthiness can be established. The balance can be achieved through a so-called granular openness of interfaces. Every inter-organizational team (project) should determine which of its domains is characterized as open or rather closed - based on the advices of the trust manager.

E. Impact of the architecture of the value creation artifact, system and process on the level/ degree of openness and the associated level of trust

Cooperation models inside the cluster should be created referring to the intensity of trust within the trust circles. The architecture of the value creation artifact and the value creation system structure affects the particular demand for openness (cf. 2.2). In this sense, 'semi-open' does not correspond to 'granular open'. The granularity of openness as a ceaseless variable has to be adapted to the respective context taking the interdependencies between openness, trust and features of the value creation artifact and system structure into account. For example, a decentralized manufacturing and assembly calls for a modular constructed product (e.g. an aircraft cabin). Therefore, the degree of the modularity of a product and the related number (and quality) of interfaces often enables openness in diverse areas of the production. On the other hand, the width and depth of the co-activity as a multilateral collaboration directly depend on the level of trust among the actors as well as systemic trust in the functioning of the system. Heterarchical cooperation models require for instance a high intensity of trust.

Trust circles are able to form a nucleus for new business models. In this regard, the role of the trust manager is important: the trust manager acts as a sensor for the demands of the community, recognizes trust circles and their potential. The most significant prerequisite for the fulfillment of the task of the trust manager is his independence regarding the individual aims of the single actors of the cluster [16]. Granular openness means that more openness (permeable interfaces) can be risked in those areas, in which social trust situations permit it and the configuration of the cooperation model requests it.

IV. SUMMARY AND OUTLOOK

Manufacturers face the prospective challenge of designing value creation through suitable developments in product, process and structure. In doing so, they tend to primarily focus on classical parameters such as time, costs and quality. Anyhow, globalization and the spread of I&C technologies are leading to completely new patterns of value creation, which can be summed up under the term 'bottom-up economics'. As the classical models for designing and explaining value creation configuration are predominantly based on top-down approaches, they are less suitable for modelling value creation. More open designs, providing interfaces for inter-organizational exchange need to be promoted in order to tap of the potential inherent to value co-creation.

Companies and stakeholders, who cooperate within value creation networks, do often act in a field of competition, uncertainty and distrust. A lack of systemic and interpersonal trust often poses a barrier for openness and a related permeability of institutional boundaries. Nevertheless, the higher the degree of openness, the more intense is the synergy, which evolves from the cooperation. This article has shown how to manage different levels of trust and exploit so-called circles of trust as a resource for new business models. Within this specific concept, the degree of openness and the arrangement of the business model (value creation artifact, process and system) can be established in a demand-oriented way depending on the level of trust by an intra-cluster trust manager.

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