

# THE CREATION OF SOCIAL AND INTELLECTUAL CAPITAL IN VIRTUAL COMMUNITIES OF PRACTICE

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## Session E-3

### Abstract

Virtual communities of practice (VCoPs) are communities of practice (CoPs) characterized by at least partially virtual interactions. CoPs are informal groups of people that share expertise and passion for actual practice within and on behalf of an organization. CoPs are said to be a more effective organizational form for knowledge creation than traditional and formal ways of structuring interaction. In this paper we strive to add to this generally assumed success hypothesis in two respects. We firstly propose an overall framework for examining the effects of VCoPs on collective knowledge creation by drawing mainly on social capital theory and the knowledge based view of the firm. Secondly, we specify testable causal hypotheses. These rely on the social structure, social capital, human capital and interaction processes in VCoPs.

**Keywords:** community of practice, social capital, intellectual capital, knowledge creation, learning in practice.

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## Abstract

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**Suggested track:** E      Communities of practice, knowledge networks and networking

## 1 Introduction

Sustaining and continually leveraging intellectual capital of firms has become an ambitious and complex task. -Globalisation and ever changing organizational structures affect the modes in which collective knowledge is created, retained, and used within a company. Traditional boundaries of departments and business lines are augmented by dispersed organizational structures and by geographic distance. One approach to overcome the resulting obstacles in learning and creation of collective intellectual capital is the concept of communities of practice (CoPs). CoPs are groups of people informally bound together by shared expertise. Furthermore, they share a passion for a joint enterprise on behalf of an organization (Wenger, 1998; Wenger and Snyder, 2000). CoPs provide arenas for learning that tend to endure even if the formal organizational structures are changing. To support effective work practices in a distributed environment, collocated CoPs are complemented by at least partially distributed CoPs called virtual communities of practice (VCoPs). VCoPs are communities of practice (CoPs) characterized by at least partially virtual interactions. CoPs are virtual to the degree (VCoPs) that members interact supported by collaborative technologies in order to bridge time and/or geographical distances. Toolkits of 'computer mediated environments' facilitate community building in addition to personal interaction (Hinds and Kiesler, 2002; Kiesler et al., 1984; Walther, 1995; Wellman et al., 1996).

Virtual communities of practice (VCoPs) are a rather new organizational form. They are said to be an especially effective organizational form for knowledge creation both within companies (Kogut and Metiu, 2001; Nahapiet and Ghoshal, 1998; von Krogh et al., 2003) and between companies (Constant, 1987; Vincenti, 1990; Hildreth et al., 2000). In this paper we strive to add to this stream of research in two respects. Firstly, we apply social capital theory and the knowledge based view of the firm to develop a framework for examining the effects of VCoPs on collective knowledge creation. Secondly, we specify testable causal hypotheses. These rely on the social structure, social capital, human capital and interaction processes in VCoPs. Possible avenues for operationalization of the involved constructs are explored. We focus our analysis on CoPs within the boundaries of a company in which participating members interact virtually to a considerable degree (VCoPs).

## 2 Basic Propositions

VCoPs are a managerially desirable form of “virtual communities” (Rheingold, 1993; Wellman et. al., 1996; Smith and Kollock, 1999) in which “learning in practice” takes place, i.e. professionals are bound together by the exposure to common problems in the execution of “real work”, shared expertise and experience, and the need to know what each other knows (Brown and Gray, 1998). Thus, identity building, voluntarism, regularity and experience through actual work practice are put center stage for building collective intellectual capital. This puts into perspective some other prevailing instruments for learning and knowledge creation as complements to functional job descriptions and traditional modes of learning as in seminars or workshops. Furthermore, it points at alternative ways for integration and motivation of employees for the creation of individual human capital and collective intellectual capital. The central concern of knowledge creation within CoPs is to install learning as an integral part of practice.

The relevance and functioning of CoPs in a knowledge context has originated in the concept of social learning as legitimate peripheral participation in “practice” (Lave and Wenger, 1991). This concept leads us to three basic propositions. Firstly we legitimate the importance of CoPs from a managerial point of view. The second proposition states that “practice” matters as locus for knowledge generation and transfer. Thirdly we identify social learning processes and social capital as constitutive elements of CoPs.

„Practice”, i.e. the execution of work relevant tasks, can take two forms: actual and espoused practice (Brown and Duguid, 1991; 1998). Espoused practice is formal and deliberately planned: formal organizational structuring, product manuals, error detection and correction procedures represent just a few examples. Actual practice represents the solutions to problems and the execution of tasks as they really happened in a given context. Processes of knowledge generation and transfer are different for espoused or actual practice (Orr, 1996). While traditional modes of organizations focus on espoused practice, VCoP as a new organizational mode represent actual practice.

Actual practice may complement espoused practice, e.g. in the form of work-arounds. At the same time, actual and espoused practices need to be compatible with one another. Too large a gap between actual and espoused practice may give rise to conflict and misunderstanding and, in the end, weak performance of employees. Therefore we conclude as a first basic proposition (BP) that actual practice gained

within VCoP provides added value above and beyond espoused practice. If this is not the case we will need to question the relevance of such an organizational form for learning in practice from a managerial point of view.

*BP1) VCoPs enhance the innovativeness and the productivity of individual actors and collectives beyond the degree of formal organizational structures.*

Espoused practice accentuates explicit knowledge that can be detached from a specific application or generative context and surfaced in a visible and apprehensible manner. Such knowledge can be transferred and made use of independently from the generative context. On contrary, soft knowledge (Hildreth et al., 2000) is not as easily articulated and cannot be readily captured. This sort of knowledge has been labelled “sticky” (von Hippel, 1994; Szulanski, 2003), “tacit” (Polanyi, 1967; Nonaka, 1994), “domain knowledge” (Sachs, 1995), and “declarative” (Cohen and Bacdayan, 1994). Individual and collective experiences as well as internalised work knowledge fall into this domain. The concept of actual practice places emphasis on the many tiny little details of problem solving activities during daily work. CoPs are an arena within which such social learning by doing is taking place (Lave, 1991; Levitt and March, 1988).

*BP2) VCoPs and formal organizational structures differ concerning processes of knowledge creation and transfer.*

Studies of CoPs bring together studies from ethnography of work (Orr, 1996) with theories of situated cognition (Suchman, 1987; Lave, 1988, 1991; Lave and Wenger, 1991). In situ learning context variables are becoming central research questions. If one wants to understand social learning processes one has to analyze the contextual embeddedness of actors (Resnick, 1991). According to Lave and Wenger (1991) the generation and transfer of knowledge inside CoPs can be sketched as follows:

1. The transformation of knowledge and learning is tied to situated action. A large part of the daily generation, application, and internalisation of knowledge is achieved during learning in practice.
2. Learning in practice is delineated by the web of relationships between actors and takes place in a social and culturally constructed environment, the community.
3. Learning in practice not only enriches individual knowledge but also the identities and roles of actors with the learning community: Newcomers learn from old-timers by the legitimation to participate in certain activities as part of the practice in the community. New members first participate as peripheral

community members. By continual learning and social identity and role building they get closer to a communities' core and become core members.

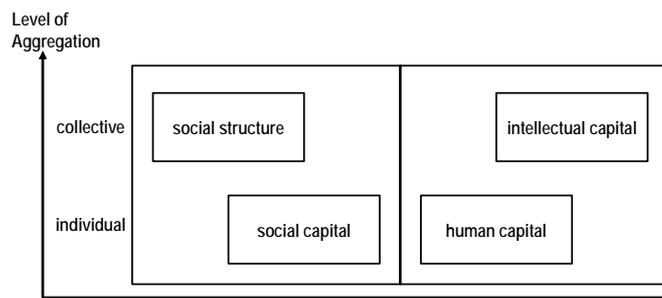
The processes of knowledge creation and transfer described above depict differences between VCoPs and formalized organizational structures. These differences are captured as our last basic proposition for our study:

*BP3) VCoPs and formal organizational structures differ because of differences in the underlying social processes between members.*

### 3 Theoretical framework

Because of the importance of mutual relationships between members of CoPs for the community as a whole, we use the concept of social capital to analyze the success of VCoPs. We discuss both, micro and macro level research levels in order to develop an integrative view of the functioning principles of VCoPs.

In the following sections, we develop a proposed framework which portrays a causal chain between the collective social structure of VCOPs (macro level) as the starting point and the collective intellectual capital (macro level) as the final dependent variable. Referring to Nahapiet and Ghoshal (1998) as well as Adler and Kwon (2002) we conceptualize this causal relationship by introducing two intermediating variables, "social capital and "human capital" on the individual actors' level. Figure 1 gives a bird's eye view on the proposed framework:



**Fig 1.** Main building blocks of the proposed framework

The framework implicitly assumes a macro-micro-micro-macro impact sequence: The social structure of VCoP delineates the social capital available to individual actors inside VCoPs. Then, the building of human capital takes place on the level of these individual actors by making use of the social capital in social interactions. Individual human capital is aggregated and consolidated through sharing processes on a

collective level. By this, intellectual capital emerges on the company level. In the next three sections we develop this framework in more detail.

Firstly, we investigate the social structure of VCoPs and the social capital available to members of Vcops and compare it to formal organizational structures. From this, we derive specific hypotheses about differences between formal organizational structures and VCoPs.

Secondly, we conceptualize individual human capital as a latent construct reflecting the variables 'motivation', 'ability' and 'opportunity' (Nahapiet and Ghoshal, 1998). These variables are being influenced by the opportunities and threats of the social capital available. Again, we develop hypotheses about differences between the type of human capital gained within formal organizational structures and within VCoPs.

Thirdly and finally, we summarize and present an integrated transformation framework. We present causal hypotheses both between derived constructs and between the constructs and the innovativeness of firms. We discuss avenues for operationalization of variables and future research.

### **3.1 Social structure of VCoPs**

For situated learning to emerge in VCOPs there needs to be a specific form of social structure. The social structure of (V)CoPs is a topic of current interest (see for example the studies about of open source software development by Kogut and Metiu, 2001; von Krogh et al., 2003; Lanzara and Morner, 2003). We profile five coordination types of social structures and discuss characteristics inherited by the social structure in VCoPs. Firstly, we discuss three basic coordination types taken from the economic distinction between markets, hierarchies and networks (Adler and Kwon, 2002). Following this, we expand the analyses by two additional coordination types taken from studies in anthropology.

Markets, hierarchies and networks represent three idealized basic dimensions of social structure within collectives. These dimensions are a result from the specific interaction patterns between actors (Adler and Kwon, 2002):

- In *markets*, resources, i.e. goods and services, are exchanged spontaneously at arms length. The relations between actors are symmetrical. Actors remain independent. Terms of trades are specific and made explicit; trades are coordinated by the price mechanism. Conflicts are solved by contracts and

enforcement of law. Access to markets is by and large open. Market relations are of a short-term nature.

- *Hierarchy* rests on explicit and formal arrangements of power. Obedience is traded against material and spiritual security. Relationships between actors are governed by formal rules. Actors depend on each other in the sense that there exists a form of domination. Conflicts are solved by exercising formal authority. Membership in hierarchies is long-term and formally restricted: access is limited to signing a contract. Contracts remain incomplete to a certain amount: not all relevant details can be anticipated and crafted in a contract a priori.
- Networks consist of cooperative relations between actors and are called *social networks* in the following. Social networks represent a hybrid coordination type that on the one hand 'lies' between markets and hierarchies but on the other hand is idiosyncratic in nature (Powell 1990). In social networks favors and gifts are exchanged. Relationships between actors are symmetric and interdependent. Coordination emerges neither as a result of formal rules nor spontaneously. It is the result of discursive practice and is facilitated by mutual trust and generalized norms of reciprocity (Gould, 1979; Putnam, 1993). Conflicts are solved by (re-)negotiation and reinterpretation of implicit terms of trade. Membership is medium-term and access to the social network is exclusive and limited.

The three coordination types discussed so far are incomplete to a significant degree when it comes to describing the social structure within VCoPs. In particular, they miss specific aspects of knowledge sharing and the specific problem solving context in actual practice. Drawing from anthropological writings, we add two additional coordination types called 'community' and 'expert culture' (Weissbach, 2000).

- *Communities* are small groups of actors that get together on a temporal finite basis. They provide for normative and ideological security, i.e. in cliques and friendship circles. Communities attract actors by what could be called 'normative pull'. Therefore, membership is open and leads to social inclusion. The normative core of communities is the means of coordination for the exchange of resources. The relations between actors are symmetrical. Actors remain independent. Exchange occurs spontaneously. Terms of exchange are implicit and exchange is therefore regulated implicitly by shared norms and values. Conflicts are dealt with by the use of normative power.

- In *expert cultures*, members are also viewed as homogenous concerning the core knowledge and activities within the VCoP: Exchange in expert culture is regulated by shared knowledge and expertise. Membership in expert cultures is generally open but governed by a common expertise necessary to participate. Developing deeper expertise can be described as a process of cognitive apprenticeship (Rogoff, 1990). The terms of exchange are implicit but specific. Boundaries against the environment are spanned on the ground of shared and exclusive expertise (social exclusion). Relationships between actors are asymmetric and interdependent. Conflicts are solved by expertise.

Figure 2 classifies the five coordination types along two dimensions of membership regulation and homogeneity/heterogeneity: The first dimension denotes the regulation of membership in collectives. Membership *duration* can be finite or infinite. *Motivation* for membership can be voluntarism or enforcement of rules. Membership can cause *consequences* as social inclusion or social exclusion. Applied to markets, hierarchies and social networks, markets are open to finite and voluntary participation (social inclusion). Hierarchy entails enforced and long-term membership contracts and causes social exclusion. Social networks combine social inclusion with exclusion: participation is neither enforced nor is it completely voluntary and noncommittal.

The second dimension denotes the degree of homogeneity or heterogeneity of actors and their relationships. The distinction between markets, hierarchy, and networks rooted in economics tends to overemphasize heterogeneity between actors and not to place enough emphasis on actor homogeneity as a feature of social reality. Markets are characterized by unrestricted heterogeneity, hierarchies by governed heterogeneity. Quite the opposite, social networks allow to account for a certain amount of homogeneity originating from learning in repeated interactions.

	<b>Homogeneity</b>	<b>Heterogeneity</b>
<b>Voluntarism, Short-Term, Social Inclusion</b>	<b>Community</b> Trust, Ideology	<b>Market</b> Exchange, Contracts & Law
	<b>Social Network</b> Trust, Pragmatism	
<b>Enforced Rules, Long-Term, Social Exclusion</b>	<b>Expert Culture</b> Shared Expertise	<b>Hierarchy</b> Authority, Formal Power & Rules

**Fig 2.** Classification of coordination types

The social structure in formal organizational structures mainly corresponds to those of hierarchies, although there is a trend in bringing more markets into organizations (Osterloh et al., 1999). In VCoPs however, we expect the social structure to include facets of different types of social structure: market, hierarchy and expert culture (Powell, 1990; Adler and Kwon, 2002). Furthermore, we suppose that it is predominantly a network based expert culture.

**Table 1:** Coordination types and VCoPs

<b>Coordination type</b>	<b>Community</b>	<b>Expert culture</b>	<b>Market</b>	<b>Social network</b>	<b>Hierarchy</b>
<i>What is exchanged?</i>	Goods and services	Obedience for knowledge security	Goods and services	Favors and gifts	Obedience for material and spiritual security
<i>How is coordination being achieved?</i>	By norms, values and ideology	By knowledge generation and transfer	By prices (money or barter)	By trust and generalized reciprocity	Formal rules
<i>Are terms of exchange specific or diffuse?</i>	Diffuse and spontaneous though grounded in norms and values	Specific along rules guided by expertise	Specific along the rules of relative prices	Diffuse (a favor will be returned at some point of time in the future)	Diffuse (not all issues can be specified ex ante)
<i>Are terms of exchange made explicit?</i>	Implicit (social inclusion by normative pull)	Implicit (social exclusion by means of exclusive expertise)	Explicit (social inclusion)	Implicit (limited social inclusion and exclusion)	Explicit (social exclusion by explicit employment contracts)
<i>Is the exchange symmetrical?</i>	Asymmetric (Normative guidance)	Asymmetric (Apprenticeship)	Symmetric (Relative prices)	Symmetric (Reciprocity)	Asymmetric (Formal domination)
<i>Actors are</i>	Independent	Dependent	Independent	Interdependent	Dependent
<i>How closed is the ,system'?</i>	Generally open	Open but rules for membership	Generally open	Limited and exclusive	Rules for formal membership
<i>Time horizon?</i>	Short-term	Long-term	Short-term	Mid-term	Long-term
<i>How are conflicts being solved?</i>	Normative power	Expertise	Contracts and law	Negotiation	Formal authority

*Remarks:* Cells in dark grey highlight the primary coordination characteristic postulated in VCoPs. Cells in light grey denote characteristics that are of secondary importance for interaction patterns in VCoPs.

According to previous research (Wenger, 1998; Adler and Kwon, 2002; Weyer, 2000; Weissbach, 2000; Wellman et al., 1996), we propose a specific combination of traits of the five dimensions as presented in Table 1. Specifically, we postulate the following characteristics of social structure in VCOPs: Exchanged are primarily goods and services that serve for building and transferring knowledge and expertise. Since contributions can not be measured accurately, favors and gifts are part of the exchange which is symmetric in contributions but asymmetric concerning the depth of expertise already gathered by different actors. Coordination in VCOPs is primarily achieved by the common knowledge learned during prior problem solving activities. The terms of exchange of goods and favors in VCOPs are left implicit and are inferred from the

centrality of actors in respect to a VCOP's normative and cognitive core. If the degree of virtuality within a VCoP is low and/or the VCoP exists for a longer time, norms and ideologies complementary coordinate exchange in VCoPs. The solution of conflicts is achieved by means of expertise.

This characterization leads us to the first hypothesis about differences (DH) in VCoPs compared to traditional formal organizational structure:

*DH1: VCoPs are characterized by a social structure with higher variety than that of formal organizational structures; specifically, the social structure of VCoPs entails (in descending order) elements of social networks, expert culture and markets.*

### **3.2 Social capital in VCoPs**

The social structure of VCOPs as a collective phenomenon provides the frame for individual social capital available to single actors within VCOPs. Adler and Kwon (2002, p. 23) define social capital as “the goodwill available to individuals or groups. Its source lies in the structure and content of the actor’s social relations. Its effects flow from the information, influence, and solidarity it makes available to the actor.” Thus, social capital is defined by its functions that it may serve to single actors (Putnam, 1993). It can be characterized along a structural, relational and cognitive dimension (Nahapiet and Ghoshal, 1998). The structural dimension denotes an individual actor’s position within a network of ties between actors (Burt, 1992; 1997; Coleman, 1988; Granovetter, 1973; Hansen, 1999). The relational dimension contains the individual content of the ties in terms of norms, trust and obligations. The cognitive dimension of social capital characterizes the perceptual scope and shared codes as well as narratives (Nahapiet and Ghoshal, 1998). The three dimensions of social capital have both positive and negative influences on the emergence of individual human capital and social competencies (Burt, 1992; Coleman, 1991; Granovetter, 1973):

**Structural dimension.** As for the structural dimension of social capital there is mixed and somewhat contradictory evidence about the effects of the *intensity* of relationships on the emergence of human capital and innovativeness of actors: Weak ties enable accessing a diverse range of other actors in terms of actor characteristics, available information, and perceptual scope (Burt, 1997). Thus, weak ties, i.e. low degrees of relationship intensity, support innovativeness of actors. In contrast, strong ties may decrease innovativeness because of rigidity caused by excessive amounts of normative cohesiveness within social networks. However, strong ties are important for sharing and transferring knowledge that is sticky by nature, i.e. highly context

dependent, confidential or complex (Hansen, 1999). Intimacy or high degrees of relationship intensity are therefore an important antecedent for the emergence of human capital (Coleman, 1991; Perry-Smith and Shalley, 2003).

As a result, we plead for a context dependent mix of weak and strong ties in VCoPs. Obviously, weak ties can be supported by the implementation of appropriate information and communication technologies (Daft and Lengel, 1986). Members can be granted broad access to the virtual resources of a network and can have a high visibility in virtual 'spaces' like virtual meeting rooms, chat rooms, discussion lists, and messaging systems. This enables a single actor to sustain a large number of weak ties relationships. However, analogous can be stated also for strong ties. Since relationships in VCoPs are only partially affected by the challenge of actor mobility, more strong ties can be sustained that could otherwise not be kept alive. Moreover, the basic characteristics of strong ties are given in VCoPs: Interactions are frequent, reciprocal, and supporting and mostly long-term. Therefore, a larger number of intensive relationships can be maintained in VCoPs than in organizational entities that rely on personal interaction exclusively (Constant et al., 1996; Kochen, 1989; Walther, 1995; Wellman et al., 1996).

**Relational Dimension.** As for the relational dimension of social capital it can be supposed that multiplex relationships, i.e. relations that exist in a multitude of differing contexts, are more valuable for the creation of human capital than non-multiplex ones. This holds because of two effects. Firstly, multiplex relationships permit accessing more diverse information and social collectives (Lea and Spears, 1995). Secondly, besides this informational advantage, the time spent in a social network supports the building of affective help relationships and therefore causes an advantage rooted in solidarity (Wellman et al., 1996). In VCoPs, identification with other actors bases on shared interests and knowledge. As a consequence, besides short-term and rather functional relationships we expect affective relations that allow for mutual help and maintenance of close contact as well. This fosters the creation of multiplex relationships and herewith stays quite in contrast to formal organizational structures (Hiltz and Turoff, 1993).

Summarizing, actors in VCoPs can draw on multiplex relationships. This is a qualitative advantage of VCoPs against formal organizational structures. In addition, they may sustain a higher number of weak and strong ties. As a consequence, the relationship pattern in VCoPs will be denser than in formal organizational structures. This leads us

to the second hypothesis concerning differences in formal organizational structures and VCoPs:

*DH2: VCoPs contain relationships between actors that are more far reaching in terms of quantity and quality than in formal organizational structures.*

**Cognitive Dimension.** The cognitive dimension of social capital in VCoPs embodies the shared context of actors as a prerequisite for social learning in VCoPs (Boisot, 1995). It consists of shared practical learning experience, shared mental maps, symbols and language codes (Huff, 1990; Weick, 1990). These elements of the shared context allow an interpretation of information in a specific sense and the transformation of the decoded information in knowledge structures that are relevant for action, i.e. sensemaking (Nahapiet and Ghoshal, 1998; Weick, 1995; Osterloh and von Wartburg, 1997). In the following, the cognitive dimension of social capital is used to describe knowledge that members in VCoPs acquired during processes of shared learning in practice. We distinguish perceptual breadth and depth.

As has been discussed above, VCoPs can be viewed as beneficial surroundings for the exchange of practical experience grounded in a shared context (Orr, 1996). Compared to formal organizational structures, the cognitive dimension of social capital in VCoPs tends to differ in two main respects from that of formal organizational structure.

*Firstly*, VCoPs permit a self organizing sorting of common interests in more specific sub-interest groups. These more focused interest groups support the generation of specialized relations among participants. Consequently, a very particular kind of experience sharing becomes possible within a close peer group and we expect a strong perceptual depth within such focused collectives (Wellman et al., 1996). *Secondly*, VCoPs support the development of personalized “theories of action” (Argyris and Schön, 1996): Participants in VCoPs may enter multiple and overlapping memberships in social collectives according to their specific interests and motivations to participate. Multiple memberships in a broad range of focused communities is enabled by the virtuality in VCoPs (Marx and Virnoche, 1997). Furthermore, learning in practice in VCoPs requires a significant investment of time in order to become a ‘senior’ community member in terms of expertise acquired. Consequently, perceptual breadth will be enhanced.

Summarizing, members of VCoPs can take part in a larger number of communities than members of organizational entities who rely on personal interaction only. Based on this presumption we expect two kinds of beneficial effects for the generation and

transfer of expertise for actual practice. Firstly, the participation in a large number of highly focused sub-communities gives rise to specialization 'rents'. Secondly, the participation in a diverse set of social collectives and a broad range of topics bring about complementarities based on scope. Perceptual breadth of actors is enhanced. Thus, we conclude with our third hypothesis about differences between VCoPs and formal organizational structures:

*DH3: VCoPs bring about both, a higher degree of perceptual breadth and perceptual depth compared to formal organizational structures.*

### **3.3 Human Capital in VCoPs**

Actors who possess social capital stemming from their membership in a VCOP are more likely to learn superior problem solutions strategies for mastering actual practice. This knowledge is exclusive because it can not be detached from the context of actual practice and only yields the optimal 'return' when applied from the generative contextual background. For members of VCoPs it therefore represents a resource that is difficult to acquire and an important facet of individual human capital.

The construct 'human capital', like 'social capital', is a metaphor relating to the subject domain of physical capital (Becker, 1975; Schultz, 1961). Actors building human capital derive skills and capabilities that allow them to act in new and innovative ways and to respond to new challenges with creative solutions. In order to make such valuable use of individual social capital, actors need to consecutively engage in collaborative interactions and cooperative processes (Nahapiet and Ghoshal, 1998; Adler and Kwon, 2002). Thus, since human capital is not built in isolation but in interactive relationships, social capital is a necessary prerequisite for the building of human capital. Relying on Adler and Kwon (2002) and Nahapiet and Ghoshal (1998) we put forward human capital as a latent construct that is underlying three sets of indicators, i.e. ability, opportunity and motivation. These three variables affect the dynamics of the interaction processes in actual practice: successful interaction is more likely to emerge and be sustained if there is firstly *opportunity*, secondly *motivation* (Csikszentmihalyi, 1990; Ostrom, 1990; Osterloh and Frey, 2000) and thirdly *ability* for actors to cooperate (Adler and Kwon, 2002).

**Opportunity.** Opportunity denotes the prospect to influence collective action by exchanging information and resources, by using authority, and by enlarging the search space explored during the creation of innovative solutions to problems. Opportunity is influenced by the chances and threats of the social capital available (Brehm and Rahn,

1997; Evans, 1996; Ostrom, 1990; Putnam, 1993). Weak ties bear a broad search scope, i.e. the generation of new and distant knowledge (exploration). Strong ties imply a tendency for an in depth reuse of knowledge, i.e. exploitation (March, 1991; Katila and Ahuja, 2002). Social capital in VCoPs allows concurrently for both, more weak and strong ties than in formal organizational structures. Therefore we expect an enlargement of the opportunity space based on informational advantages and an enrichment of creative problem solution strategies through widened search spaces. VCoPs entail a higher degree of multiplexity in actor relationships. Multiplex relationship will also bring about informational advantages and a widening of search scope. In addition, the existence of shared cognitive models in VCoPs enhances the probability that individual actors can influence collective action. This holds since collective knowledge structures established in processes of collective sensemaking permit to share interpretations of new information quickly and to respond promptly in appropriate collective action. Therefore we propose that social capital causes positive effects on opportunities for individual members of VCoPs to participate in collective actual practice.

**Motivation.** Motivation is the force to act as a part of and to contribute to a social collective. The decision whether a specific activity will be carried on behalf of a community by an individual actor is influenced positively by the available social capital (Burt, 1992; Uzzi, 1999). We suppose that in VCoPs intrinsic motivation can be observed in high gear (Osterloh and Frey, 2000). This holds primarily because of the kind of knowledge exchanged in VCoPs: in order to be able to profit from expertise in VCoPs, one should have been part of the knowledge generating activities in actual practice. Generalized norms of reciprocity can further enhance the motivation to participate: members of VCoPs expect to be returned a favor by a community member at some point in the future if they do another member a favor in the first place. Furthermore, since membership in VCoPs is voluntary we expect that efforts for learning in practice are powered by self set goals and compensated for by so called 'flows' (Csikszentmihalyi, 1990; Osterloh and Frey, 2000). These effects lead to a realization of solidarity advantages and a positive motivation to participate in exchange and practice in VCoPs compared to formal organizational structure.

**Ability.** Ability in VCoPs denotes the skills and capabilities of members (Leana and Van Buren, 1999; Nahapiet and Ghoshal, 1998). Learning in practice enriches the pool of capabilities within a VCoP. These acquired capabilities enable participants to act and react in new and creative ways to challenges (Coleman, 1991). We expect a positive

impact of social capital on the abilities of members in VCoPs through an amplified interplay of the structural and cognitive dimensions of social capital. The structural pattern causes an information advantage through enhanced information diversity and therefore an antecedent for knowledge creation in VCoPs. The cognitive dimension supports the transformation of the informational advantage into a knowledge advantage. These increasing benefits enhance the abilities of actors to gain successful results in future learning in practice 'cycles' (Nonaka, 1994). The process is moderated by the degree of virtuality in CoPs. Too high a degree of virtuality can lower the density of relationship patterns in CoPs and can slow down the emergence of a shared knowledge context. In our proposed transformation framework below we use the degree of virtuality of CoPs as a moderator variable.

The discussion of human capital in VCoPs leads us to the fourth hypothesis about differences in VCoPs and formal organizational structures:

*DH4: VCoPs enhance the human capital available to individual actors compared to formal organizational structures.*

### **3.4. Collective intellectual capital**

Human capital is tied to individual actors, whereas intellectual capital is tied to collectives. Nahapiet and Ghoshal define the latter as follows: "Intellectual capital refers to the knowledge and knowing capability of a social collectivity, such as an organization, intellectual community, or professional practice. [...] thus represents a valuable resource and a capability for action based in knowledge and knowing [...] Our definition [...] acknowledges the significance of socially [...] as a source of value differing from the simple aggregation of the knowledge of a set of individuals..." Nahapiet and Ghoshal 1998: 245f.).

"Collective intellectual capital serves as a measure for the evaluation of VCoP-success. It has been disputed whether and how the term 'learning' can be transferred on a collective level (Kim, 1993; Kogut and Zander, 1993; Argyris and Schön, 1996; Spender, 1996). In the following, collective intellectual capital is conceived as the 'aggregation' of individual human capital in a sense that the aggregation may be more than the sum of its parts. VCoPs will be called successful if their social structure brings about individual social capital that enriches collective intellectual capital via an enhancement of individual human capital. The definition above encompasses both 'knowledge' and 'knowing'. Knowing is inextricably tied to the situated problem solving context. An explicit description of that context dependent expertise is usually neither

possible nor desirable (Polanyi, 1967; Cook and Brown, 1999). It carries an unconscious and implicit connotation that can be reflected by the difference between procedural and declarative memory (Cohen and Bacdayan, 1994). Knowledge on the other hand is expertise that can be made explicit requiring more or less effort and hence causing more or less costs. For the emergence of successful learning in actual practice, knowledge and learning must be bridged creatively in accordance to the requirements of a specific problem solving situation (Cook and Brown, 1999). Intellectual capital is built and enriched in collective processes of knowledge combination and exchange. Exchange processes cause a mobility in the information sources underlying knowledge. Processes of combination are the origin of new interpretations of this information against the background of prior knowledge. This prior knowledge is called absorptive capacity (Cohen and Levinthal, 1990). Absorptive capacity is said to cause a long-term increase in innovativeness of firms.

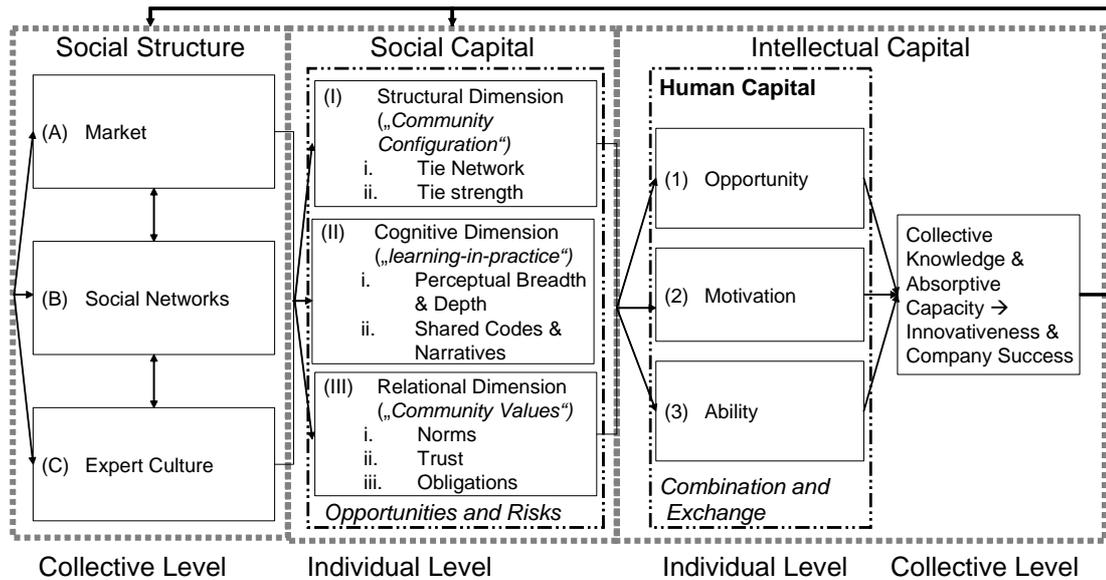
Thus, we derive the last hypothesis about differences between VCoPs and formal organizational structures:

*DH5: VCoPs are significantly different from formal organizational structures in terms of the developed amount of collective intellectual capital.*

In the following section we discuss the different constructs introduced so far in an integrative transformation framework.

#### **4 Integrative transformation framework**

The integrative transformation framework presented in figure 3 combines the models of Adler and Kwon (2002) and Nahapiet and Ghoshal (1998). Social structure and social capital are characterized as in Adler and Kwon (2002). The distinction between ability, motivation, and opportunity bases both on Adler and Kwon (2002) and on Nahapiet and Ghoshal (1998). The latter relate the three dimensions to the emergence of intellectual capital.



**Fig 3.** The proposed framework of VCOPs as knowledge creation enabling entities

The construct ‘social structure’ is representing the system condition at the macro level. It guides individual action by a mixture elements of the discussed of coordination types. More specifically, the social structure in VCoPs is combining elements of markets, social networks and expert culture. The concrete occurrence of social structure in VCoPs is dependent on the degree of virtuality in CoPs. The construct ‘social capital’ represents the individual situated logic for activities and relationships on the actor-micro level.

This leads to the first causal hypothesis (CH):

*CH1: The social structure of VCoPs determines the amount of social capital that can be acquired by individual actors.*

Following Nahapiet and Ghoshal (1998) we separated three dimensions of social capital, i.e. the structural, relational and cognitive dimension. The former two identify the ‘learning community’ aspect of VCoPs. The latter puts forward the notion of ‘learning in practice’ (Lave, 1988, 1991).

Intellectual capital qualifies the direct effects of (1) the situated opportunities and threats of social capital on the micro-level on individual human capital. Derived there from is the aggregation of individual human capital into intellectual capital on the macro-level. We thus conclude the second and third causal hypotheses:

*CH2: Social capital built in VCoPs effects the human capital in VCoPs by shaping the indicating dimensions of human capital, i.e. opportunity, motivation, and ability.*

*CH3: Human capital built in VCoPs leads to an enrichment of collective intellectual capital on a macro-organizational level.*

Summarizing we expect to find a causal path that leads from social structure, to social capital (CH1), human capital (CH2) and finally to collective intellectual capital (CH3) and that helps explaining the proposed differences between VCoPs and formal organizational structures (DH1 – DH5).

This causal chain is highly idealized and neglects feedback-loops and human/social capital on a macro-level. However, it is compatible with a managerial point of view: the partly designable parameters of social structure in VCoPs effect the intermediary and more difficult to influence micro-level constructs, i.e. social capital and human capital. If one assumes firstly a partial designability of social structure in VCoPs and secondly the validity of the causal effects put forward, one will be able to meet objections stating that VCoPs are emerging social phenomena which can by no means be designed or used in a planned manner. These objections do not hold since the surrounding context of VCoPs is designable. Moreover, proposing the underlying working principles of VCoPs as a causal chain encompassing more than two consecutive causal stages enables a 'measuring of success' or at least an evaluation of the outcomes of social collectives called VCoPs (Wenger, 1998; Wenger and Snyder, 2000).

In sum, the success hypothesis of VCoPs as an effective organizational mode for the creation and enrichment of intellectual capital bases on following argumentation: Firstly, we expect superior knowledge generation processes to occur in VCoPs during learning-in-actual-practice. Secondly, we expect a superior potential for exploitation of the generated knowledge to be created because of an augmented absorptive capacity. This in turn should finally lead to higher and more sustained rate of innovation in products and processes on an organizational level (Cohen and Levinthal, 1990; Cook and Brown, 1999; Spender, 1996):

*DH5: VCoPs promise to lead to enhanced innovativeness and company success compared to hierarchically formal organizational structures.*

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