Challenges of ICT-enabled Virtual Organisations – a Social Capital perspective

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Abstract

Relying on ICT-based collaboration, virtual organisations promise to be the appropriate organisational form to facilitate innovation. Although much has been written about the propositions and structural characteristics of virtual organisations, their limitations remain largely unaddressed. By applying social capital theory we are able to identify inherent contradictions and challenges of virtual organisations, which result from a mismatch between task requirements and organisational structures. Our analysis leads us to suggest a few remedies.Abstract paragraph

Keywords

Virtual Organisation, Social Capital, Innovation, Collaboration, Knowledge creation, Virtual Teams Keywords

INTRODUCTION

Technological and organisational developments become increasingly intertwined. Organisational changes call for new information and communication technology (ICT). ICT at the same time enables new organisational forms, in particular virtual organisations (VO). In VOs, individual companies aim to achieve joint advantages in a best-of-breed arrangement by pooling their resources in inter-firm networks. Firms concentrate on core competencies to achieve individual excellence by capitalizing on specialization effects. Making use of new ICT, these arrangements typically are used for joint projects that are limited in duration and involve complex and often innovative tasks such as research and design or customized manufacturing.

Regarding the structural setup of VOs, literature mainly takes a static structural and technocratic view: technology enables distributed collaboration. While the promises of VOs like achieving excellence or virtual size by pooling resources are obvious, the resulting challenges have been much less addressed. However, there is an obvious gap between the VO hype and the number of successful cases. Surprisingly, the managerial and, in particular, the social challenges of virtual inter-firm collaboration in these arrangements tend to be overlooked. This is all the more astonishing given the fact that VOs have to rely on collaboration for carrying out complex tasks. And since collaboration in complex innovation projects is based on social interactions between people, social structures are needed to ensure efficiency and effectiveness of joint work. Not only does collaboration have to be based on trust, equally important is the establishment of a shared understanding of the joint task and the ability to create knowledge as a group. While initial trust might emerge quickly, shared understanding is much harder to achieve. Thus, while people might be willing and motivated to collaborate empowered by ICT, the lack of shared understanding might prevent them from doing so effectively. Whereas superior individual excellence in terms of human (and intellectual) capital is the basis for VO success, we argue that without social capital as the necessary complement, collaboration in the VO is unlikely to succeed. Superior human capital provides the VO with the necessary competence pool. But the ability and motivation of individuals to collaborate in teams is crucially dependent on appropriate social structure among them (see figure 1). And the emergence of social capital is dependent on effective group formation processes in the VO setup.

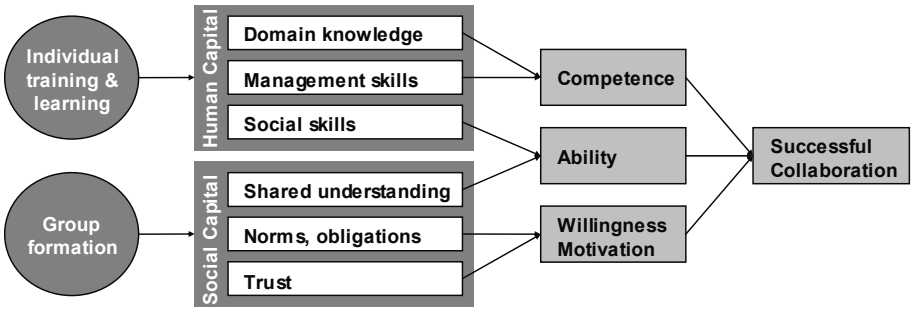

Figure 1: Social Capital as a necessary complement to human capital for successful VO collaboration.

Two of the main structural propositions of virtual organisations, virtuality and limited duration, impede the emergence of social capital. Virtuality refers to distributed, ICT-based work arrangements that keep people from meeting regularly, whereas the limited duration of projects leads to a volatile work setting that renders the formation of sustainable social structures a challenging task. Hence, while there is little doubt about the promises and benefits of virtual organisations, their efficient functioning and the achievements of the intended benefits are challenged by the very nature of these arrangements. Consequently, the core question for the success of VOs is:

> *Given that companies collaborate based on a computer-mediated infrastructure in short-term projects in a volatile competitive environment, what are the prerequisites – motivational and capability wise - to turn individual strengths into collaborative advantage?*

In this conceptual paper we will point out the inherent structural contradictions and challenges of the VO concept by juxtaposing its structural characteristics with its task characteristics and related requirements. Social capital theory leads us to uncover shortcomings and contradictions in the organisational proposition of the virtual organisation, particularly regarding the nature of collaboration in innovative, ill-structured tasks. We will challenge the idea of having merely virtual arrangements as social capital has to evolve over time and social interactions cannot be sufficiently substituted by technology. Using the notion of social capital, we present some remedies how to incorporate the required social structures to the VO concept. We begin our analysis with defining and pointing out the constituent characteristics of virtual organisations, from which we will further deduce our arguments.

CHARACTERISTICS OF VIRTUAL ORGANISATION

Emergence of VO

Market changes and emerging new ICT have a profound and lasting impact on the way business is conducted. The globalization of markets, driven by the emergence of new ICT, causes market structures to erode while costs of market entrance are decreasing (Bleecker 1994) and new competition is arising (Franke 2001). An increasing demand for customized products and the fragmentation of markets call for new and efficient ways to organize value creation. In response new mass customization strategies have been developed to tailor outputs and meet customer needs (Franke 2001, Saabeel et al. 2002). Significantly lower costs of processing and transmitting information within and between firms spur radical changes in their operations. Consequently, companies increasingly seek to cooperate and share risks in joint initiatives (Goldman et al. 1995). Furthermore, companies face an increasing importance of knowledge for value creation and a rising dependency on innovation and new services. Today, even big companies are not able to access and control all necessary information and knowledge available in the market. Challenged by these developments, companies try out new strategies and change their structures by experimenting with new organisational forms (Bleecker 1994, Venkatraman/Henderson 1998). Scholars have stated that "the current models of strategy and structure are woefully inadequate to meet the imminent challenges of the information age" (Venkatraman/Henderson 1998). Based on market requirements and new opportunities created by ICT, they argue in favour of new ways of value creation in virtual corporations, virtual enterprises or virtual organisations.

Types and definitions

Since there is no consensus of what a VO is, we will clarify our understanding. Starting from the meaning and etymology of the term 'virtual', two basic connotation of virtualisation can be distinguished. Firstly, organisational virtualisation refers to the changes in organisational structures towards disintegrated setups to make organisations more flexible in response to the above mentioned challenges. Virtual in this sense means 'unreal, looking real' (Bultje/van Wijk 1998). Hence, assembled of independent firms, a VO aims at looking real

and pretending to be a real organisation. A VO thus is 'virtual' in that it is really not one homogeneous organisation, but a hybrid of groups and individuals from different companies. It is an 'as if' organisation, a network of firms flexibly formed to be a new – often temporary – organisation (Franke 2001, Tuma 1998, Saabeel et al. 2002). Secondly, technological virtualisation refers to the intensive usage of ICT. Virtual here means 'immaterial, supported by ICT' and is connected to the notion that ICT is used to replace functions that formerly have been conducted by people (Bultje/van Wijk 1998) or that ICT is used to connect spatially dispersed teams (Franke 2001). The first perspective thus is a network view of virtualisation that compares a virtual (network) organisation with a traditional integrated firm, whilst the latter one compares a virtual (ICT-based) organisation with a traditional one. Whereas some authors concentrate on either the ICT-based view or the organisational network view, it is the combination of both – an ICT-based network of independent organisations – that has inspired many authors.

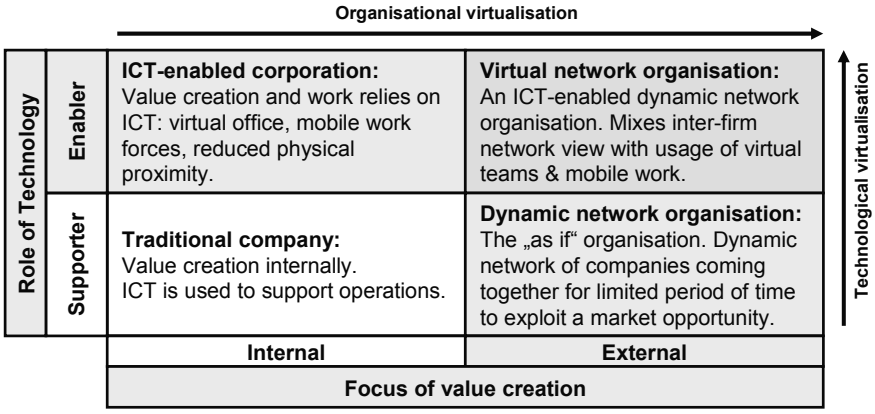

Figure 2: Typology of virtual organisations

Based on the level of virtualisation, we can distinguish three types of VOs (see figure 2):

- The **ICT-enabled corporation** is a single firm that builds its operations on ICT "by placing IT at the centre." (Venkatraman/Henderson 1998). New ICT in this sense bridges time and space and facilitates the emergence of virtual teams (Lipnack/Stamps 2000). In this notion, a virtual organisation is a geographically dispersed organisation, in which travel for the purpose of exchanging information is minimised. Thus, companies rely on remote workers or what Bleecker calls the "mobile knowledge worker" (1994).
- The **dynamic network organisation** represents "the virtual organisation as a co-operative partnership (…) of independent economic actors that join forces on a temporary basis in order to achieve a common goal." (Franke 2001). It can be seen as a "temporary, project-dependent portfolio of core competencies" (Tuma 1998). The underlying logic thus is that of a "best of everything organisation" (Tuma 1998), or metaphorically that of an All Star Team (Goldman et al. 1995) that integrates the best players to represent superior strength, respectively to gain collaborative advantage in innovative areas. A VO thus is a special type of organisational network with firms collaborating to achieve "virtual size" by maintaining their own flexibility (Riemer et al. 2001). It is opportunistic in that it tries to flexibly capitalize on arising market opportunities (Goldman et al. 1995) and it has a medium-range planning horizon (Tuma 1998). Collaboration is complex and dealing with mass customisation (Saabeel et al. 2002) or new product development (Franke 2001).
- The **virtual network organisation** as a combination of the former two is the most complex type of VO namely a flexible and temporal inter-firm network, where the partners "are dependent upon electronic connections (ICT infrastructure) for the co-ordination of their activities" (Bultje/van Wijk 1998). Communication and interaction thus is ICT-based, including "the global collaboration of distributed cross-functional expert teams" (Franke 2001).

In our analysis we focus on virtual network organisations. Even though they are the most popular in literature, they are the most demanding and the rarest form of VOs in practice. For the matter of simplicity, we will use 'VO' synonymously to 'virtual network organisation' from here on.

Constituent characteristics of the virtual network organisation

As companies find themselves in highly competitive and volatile environments, they aim to join forces in order to achieve collaborative advantages. Tasks in the VO are characterised by fulfilling innovative complex, often customer specific tasks that involve significant research and new product development. According to Franke

"virtual teams pursue the aim of concurrent engineering of products, services and business processes." (Franke 2001). In fact, VOs are supposed to be the emerging new organisational form for innovation to take place (Wigand 1998).

The VO seems particularly appealing to small and medium sized companies for achieving virtual size and collaborative advantage to compete with large firms (Goldman et al. 1995, Franke 2001). Individual companies set up inter-organisational webs from which project teams or task forces can be built to flexibly meet market opportunities (Goldman et al. 1995, Franke 2001, Saabeel et al. 2002). VOs thus often encompass a pool of companies as the basis for collaboration from which specific projects can be initiated that contain (some) pool partners at a time and that are limited in duration (Riemer et al. 2001). Consequently, this division of labour implies that companies have to collaborate to integrate their competencies and the capabilities of their people in joint projects. The envisioned collaborative competence requires appropriate management structures to facilitate the integration of the individual capabilities into a functioning team. As we will argue, this can be a challenging task since diversity, different organisational backgrounds and cultural differences among the network members have to be addressed.

Another main characteristic of the VO and the main managerial innovation according to Mowshowitz is the switching principle (1997, 1999). The flexible (re)combination of individual competencies to form projects in response to market opportunities makes the VO able to adapt to market changes (Goldman et al. 1995). This results in flexible and fluid arrangements (Franke 2001) with limited duration of actual projects (e.g. Saabeel 2002). The resulting volatility however is challenging for the setup, management and functioning of the project teams. In addition, virtual organisations are supposed to be enabled by and to rely heavily on modern ICT for communication and the coordination of tasks in order to reduce the associated coordination cost. Thus, virtual team setups are used to span time and space and fulfil the collaborative work based on ICT usage (Lipnack/Stamps 1997).

Table 1 sums up the VO characteristics and points to resulting implications. By juxtaposing these structural characteristics and specifically by looking at the nature of tasks, we will point out inherent challenges of virtual network organisations. We will argue for a need of social capital in establishing collaborative competencies and the challenging nature of virtuality and volatility for social capital to emerge.

Characteristics	Implications
Highly competitive and volatile environments	Companies aim at joining forces to create collaborative advantages through new organisational arrangements.
Best of breed: focus on core competence	Companies have to collaborate to achieve collaborative advantage. But collaborative competence (being able to perform in a team of excellent players) is quite different from individual excellence in a specific area.
Organisational virtuality	Inter-firm collaboration poses questions of diversity, different organisational background and cultural differences.
Task complexity: innovation, complex work, customization, knowledge creation.	Many envisioned VO tasks are ill-structured. Highly complex work in a virtual environment is demanding for both management and employees in teams.
Volatility and flexibility: fast in, fast out	While the flexibility of virtual organisations is appealing, the set up of a project team is demanding, in particular as the time to learn to collaborate is tight.
Polycentrism and lack of hierarchy	Formation of projects implies the usage of market mechanisms. Internal competition within the pool for participation in project possible.
Short term project: switching and adaptability	How can incentives for the project team members be designed to make them contribute to a short term project, while they have long term goals themselves?
Technological virtuality	Individuals in diverse and spatially dispersed (virtual) teams have to collaborate in highly complex inter-firm projects. The resulting challenges have been mainly unaddressed in VO literature so far.

Table 1: Characteristics of virtual network organisations and implications

INNOVATION ALL ILL-STRUCTURED TASKS REQUIRE SOCIAL CAPITAL

In order to understand the organisational, technical and managerial requirements of VOs, we need to scrutinize the task structure and to distinguish between different types of VO projects, before we can then point to specific requirements in terms of capabilities. It is the linking of individual capabilities of their member organisations and the integration of the individuals to a team that is particularly challenging for the VO to succeed. Scholars

assume that by forming a long-term pool of organisations, the collaborating firms will be able to form projects quickly and to collaborate effectively (Saabeel et al. 2002, Franke 2001). However, the actual challenges and requirements on a task level and the required structures and capabilities on a managerial and group level have not been sufficiently addressed so far. By distinguishing between different tasks we will point to different requirements and we will eventually stress the structural propositions of the virtual network organisation by pointing out inherent contradictions within the concept that only become obvious when looking at the task level of collaboration.

Ill-structured and well-structured tasks

The VO aims at fulfilling complex and innovative tasks by linking together core competencies to achieve collaborative advantage. In this context we can distinguish tasks according to their degree of standardization. On the one end of the continuum we find well-structured tasks (e.g. well specified engineering projects), whereas on the other end we find truly innovative tasks, which are only poorly defined (Mintzberg et al. 1976). Well-structured tasks have the advantage that the resulting project can be ex ante subdivided into work packages and work can be coordinated based on the performance of well-defined outcomes. However, the majority of innovative and customer specific projects cannot be (fully) specified initially. Rather, the work is ill-structured and has to rely on negotiations and alignments between individuals throughout the project.

Scholars addressing management issues of the virtual network organisation seem to either assume that work in the VO can be specified (Tuma 1998, Franke 2001) or state that work has to be standardized in order to be governed by a central management entity (O'Sullivan 2003). Following this literature, governance in the VO requires a well-structured project formation and management, i.e. a clear decomposition of the project into sub-tasks, an assignment of work packages to individual partners, controlling and coordination of the project, the dissolution of the project team after the task has been accomplished, as well as the redistribution of project earnings among the partners (Tuma 1998). Franke introduced the concept of the net-broker as a central coordination entity that maintains the pool of companies, forms the temporary project team, and manages the entire project life-cycle (2001). Besides the fact that the introduction of a potent role appears to contradict the idea of a VO as a flexible, non-hierarchical organisation (Tuma 1998), a central broker also is inappropriate to govern ill-structured tasks. Innovative tasks cannot be specified in the beginning of a project, the project accordingly cannot be governed output-oriented. Consequently, ill-structured tasks need a different management approach that takes care of the social nature of innovative work and that can be described by using the notion of knowledge creation.

Innovation and knowledge creation as social process

According to Nonaka and Takeuchi (1995), knowledge creation in innovation is a social process undertaken by individuals (not organisations) that involves tacit and explicit knowledge. Knowledge creation generally begins with a process of sharing tacit knowledge among individuals with the aim of aligning the individual mental models and deriving a group-level understanding of the relevant cognitive issues to create a basis for successful collaboration (Nonaka/Takeuchi 1995). This means that experts within the VO who come from different firms with different backgrounds and who therefore have different mental models, first of all have to find a shared cognitive basis for their collaborative work. They have to "learn to communicate more effectively by developing a better understanding of how each uses language, the categories that are important to them, the heuristics they employ, and the forms of verbal and nonverbal shorthand and codes they use." (Nohria/Eccles 1992). Thus, management in the VO has to create the context and structures for the required social interactions.

A focal actor like the net-broker (Franke 2001) cannot design the group structures that are necessary as a basis for the social interactions, nor is she able to impose social alignments to individual actors. Consequently, ill-structured tasks call for suitable organisational structures and a different management approach that is based on leadership and relationship management among individuals (see Goleman 1995), rather than planning and coordinating pre-specified tasks. Management has to nurture and rely on the collaborative capabilities of the project team. It is the first stage of socialization and sense making in the process of knowledge creation that requires the existence or emergence of social capital as a necessary complement to individual capabilities to cater for effective collaboration and group work. Following this distinction of tasks, we state that the VO either requires a well-defined management and coordination approach in cases where work can be specified in a fairly standardized way, or that it has to create the right context for social capital to be built as a prerequisite for solving ill-structured tasks in innovative knowledge creation projects.

Introduction to Social Capital

Social capital theory is an emerging body of concepts that acknowledges the inherent value of social structures. Social capital can generally be defined and interpreted on an individual and on a group level. On an individual

level, it is defined as "the ability of actors to secure benefits by virtue of membership in social networks or other social structures" (for this and further definitions refer to Adler/Kwon 2000). Since we are dealing with group related issues, we will concentrate on the group level interpretation that refers to social capital as the value of social structures in facilitating social action. Social networks and relationships in this respect function as valuable organisational resources that enable individuals to act as groups and to undertake complex actions like knowledge creation (Nahapiet/Goshal 1998). Social capital thus can be seen as a necessary complement to human capital (Coleman 1988). Whereas human capital refers to the knowledge and capabilities of the collaborating individuals, social capital takes into account the social fabric among these individuals that is necessary for effective collaboration to take place. It thus refers to the capabilities of a team to act collaboratively, which involves issues like trust, shared cognitive models and the ability to process complex information. According to Nahapiet and Goshal we can distinguish three dimensions of social capital: the structural, the relational and the cognitive dimension (1998):

- The **structural dimension** of social capital comprises the relationships between the individuals of a social group that create the opportunity to act together (Adler/Kwon 2002, 24). One proposition of social capital is that through social relationships people get access to resources (like information) that are held by others. Social relationships in and between groups thus constitute information channels allowing people to exchange information, which is one prerequisite for knowledge creation to take place (Nahapiet/Goshal 1998). Besides this, group structure in terms of density or closure refers to the degree of interconnection between the members of a group (team) that allows for the observance of social norms (Coleman 1988) and facilitates trust and strengthens the so called "absorptive capacity" of a group, the ability to accumulate and create new knowledge (Cohen/Levinthal 1990).
- The **relational dimension** is related to the willingness of people to act together by subordinating their individual desires to group objectives. It comprises trust, norms and obligations. Individuals need to trust to be willing to collaborate with others. Trust is defined as the willingness to take a risk or to accept the vulnerability towards others in an interaction. Norms refer to a form of immanent control enforced by a social group on its individual members. Norms like openness, teamwork and an emphasis on collaborative rather then competitive behaviour are likely to enforce cooperative individual behaviour (Nahapiet/Goshal 1998). Finally, obligations are created by acting collaboratively towards others. Obligations can function as social credits and ensure collaborative behaviour by others in the future. This is referred to as the reciprocity principle of social capital.
- The **cognitive dimension** refers to the ability of people to act together; it comprises the issues of shared understanding and shared mental models to which we referred earlier in this section (Nahapiet/Goshal 1998). People have to align their mental models and to establish a shared language and shared codes to be able to collaborate effectively. It is further important for a group to derive a collective goal orientation to ensure the effectiveness of collaboration (Leana, van Buren 1999).

Drawing from this detailed view of social capital, the benefits of social capital are basically twofold: social capital has informational and collaborative benefits. Informational benefits are related to information flow and information exchange. Individuals are able to access information through their social, often informal relationships. And groups are able to process information effectively when they possess sufficient social capital, especially in terms of relational and cognitive aspects. Social capital thus facilitates information flows and enhances information processing capacity of groups. On the other hand, the collaborative benefits of social capital (Nahapiet/Goshal 1998) refer to the willingness and ability of group members to act together. The collaborative ability results from group closure, trust, norms and a shared group understanding as introduced above. To sum up, social capital refers to the value of social arrangements comprising structural, relational, and cognitive aspects and provides social groups with the ability to process information and act together.

The need for Social Capital to fulfil ill-structured tasks

Standardization of tasks aims at reducing the range of possible interpretations of the work and its outputs to allow individuals that come from different companies to form accurate and convergent expectation of their work (O'Sullivan 2003). Standardization reduces (or even replaces) the need for group-level alignments to be made and consequently the need for collaborative capabilities. However, standardization is not feasible for ill-structured tasks, so that collaboration in this case has to rely on social capital as it comprises the group structures, the cognitive alignments and trust to facilitate the process of knowledge creation.

Social capital provides the conditions that are necessary for the informational and collaborative processes in creation of knowledge (see Nahapiet/Goshal 1998). People have to have relationships to get the opportunity to exchange and combine information. And they have to be willing and able to collaborate with others in the process of knowledge creation. We thus argue that ill-structured tasks in VOs need collaborative capabilities of the team to be able to adapt to complex problems as a group. According to figure 1, we interpret these

capabilities as social capital that is required as a complement to the excellence in human capital that makes up the VO project team. The analogy of the All Star Team suggests that having the best players does not automatically lead to superior team play. To act as a team and capitalize on the individual superior capabilities, players have to be willing to play together by subordinating their own interests and to learn to adapt to the other players in the team. By training and practising, they learn the style and specialities of their team mates and derive a shared understanding for the game. This finally involves tacit team understanding as well as explicit team tactics.

INHERENT CONTRADICTIONS AND CHALLENGES

In order to point out the inherent contradictions and challenges in the VO concept, we will now juxtapose the requirements of ill-structured tasks in terms of social capital with the organisational characteristics of the virtual network organisation. Our basic hypothesis is that the organisational structures of the VO, the inter-firm nature, project lengths and switching principle, as well as the proposed technical infrastructure do not match the task requirements.

Volatility and the switching principle do not match task requirements

VOs are conceptualized in contrast to hierarchies (Tuma 1998) and similar to markets. They give emphasis to flexibility, polycentrism, limited duration, and the combination of resources based on market mechanisms (Miles/Snow 1986). Hence they also face the typical shortcomings of markets. Thus, when quality matters, non-contractible issues, particularly mutual trust and commitment to the joint task need to be addressed (Bakos/Brynjolfsson 1993), Since only long-term relationships provide the incentives to invest in ICT and in the requisite organisational adaptations, learning processes and social relationships, as well as the safeguards against the risks of opportunistic behaviour and especially the loss of critical resources (Clemons/Row 1992), we can identify a mismatch of these structures with the requirements of innovative, particularly ill-structured tasks. The limited duration of projects and the switching principle create a volatile work environment that provides little incentives for people to invest in social capital and to engage in time consuming social alignments. In fact, people brought together in such a volatile setup will face the paradox that they are expected to form teams quickly in order to collaborate, but that collaboration usually only develops in long-term relationships (Larsen/McInerney 2002). The literature on VO, however, does not properly address the challenge of creating incentives for participants to contribute to short term projects according to their abilities. Nor does it elaborate on the challenges of managing the dynamics of collaborative competence development and social capital investments. Thus, we state that volatility in terms of quick project formation and swiftly switching to new setups hampers the emergence of social capital in the VO and thus threatens effective collaboration that is required to carry out ill-structured tasks.

Organisational virtuality and team diversity challenge effective collaboration

Since virtual network organisations are based on the idea of a best of breed collaboration among organisations that concentrate on core competencies, they bring together specialized experts. Hence, a virtual network organisation can well capitalize on having superior expertise and human capital. Virtual network organisations face, however, the challenge of diversity. With increasing group diversity the achievement of group cohesion and the negotiation of a shared understanding becomes more challenging. Members of teams with diverse knowledge and different professional backgrounds face the challenge of integrating their knowledge and are likely to have higher levels of social uncertainty than homogeneous teams (Anand et al. 2003). And diverse teams in an inter-organisational context are even more challenging: “The major challenge with these teams is enhancing the likelihood that integration and (knowledge) creation actually occurs (Anand et al. 2003).” One of the major problems here is the cultural barriers (Hall 1995). People from different organisations do things differently; they say things differently and behave differently. Hence the necessary alignment process becomes even more challenging. If groups and their managers are not able to overcome these social barriers, they might cause a “downward spiral of misunderstandings, mistrust of intention, conflict and a broken relationship.” (Hall 1995). Interestingly, the statement shows that, although often discussed in the context of VOs, trust (or distrust) might initially not be the major issue in the setup of virtual network organisations.

Correspondingly, research has shown that cooperation in inter-firm arrangements, even in temporary ones, can be based on a form of swift trust (Meyerson et al. 1996). This form of trust is derived from role-based trust or an initial willingness of people to cooperate and the corresponding assumption that the others will reciprocate. Role based trust refers to trust in professional roles in the absence of an existing personal relationship: a knowledge expert in a certain area is trusted to be competent and willing to act collaboratively to achieve the joint goal (Meyerson et al. 1995). Thus, although a trusting relationship has to emerge over time, initial trust is possible. Our argument however is that even if initial trust and a willingness to collaborate exist (even if it cannot be

automatically assumed), the effective collaboration requires a shared cognitive basis: if people are not able to derive a mutual understanding on a group level, they might enter the above mentioned downward spiral that can lead to distrust and project failure. Hence we have opted for the richer social capital theory as the conceptual basis for our argument instead of concentrating on trust.

Drawing from this, we argue that the players in the All Star Team example might be willing to collaborate to achieve a joint goal, i.e. winning a competition. The players might not know each other when they first meet, but they can trust in each others' abilities, because that is why they are all part of the team. However, since the players come from different teams with different styles, tactics and communication behaviour, we cannot assume that they will be able to play as a team without training. Without an (often tacit) alignment process in training and preparation matches in which players become familiar with each other, distrust and competitive behaviour might prevail. Hence, the inter-organisational nature of the VO challenges the formation of teams. The emergence of social capital is hampered by diversity and cultural barriers, which render the facilitation of social structures and group closure a challenging task.

Technological virtuality and the reliance on ICT challenge effective collaboration

Whereas organisational virtuality refers to the inter-firm nature of work, technological virtuality points to ICT usage. Media richness theory claims that there has to be a fit between technology and task structure (for an overview see Andres 2002). Lean media (text messaging, e-mail) are best used to transmit information that is needed to fulfil well-structured tasks, whereas rich media (face-to-face, videoconferencing) are used to reduce task related ambiguity (Andres 2002). Moreover, the impact of communication media depends largely on the underlying relationships of the communication partners. Since well-structured tasks are pre-specified to avoid ambiguity, the usage of ICT for the coordination of work seems to be appropriate. But using ICT to support work in geographically distributed teams is particularly challenging. Whereas "ICT allows organisations to bridge time and distance barriers with once undreamed ease" (Kaspar-Fuehrer/Ashkanasy 2001), it creates new barriers in a social sense that lead to problems of interpreting the transmitted information (e.g. Nohria/Eccles 1992; Andres 2002). So, even people working on well-defined tasks in a virtual environment are in danger of becoming "socially as well as physically remote" (Putnam 2001).

However, extensive research has shown that social action for ill-structured tasks cannot be done with the sole use of ICT. When it comes to complex tasks, face-to-face interaction is still superior to ICT-based communication, despite the recent advances in ICT (Andres 2002). This discussion is stamped by the issues of trust creation in electronically mediated distance (e.g. Lipnack/Stamps 2000; Kaspar-Fuehrer/Ashkanasy 2001). Here again, scholars have shown that virtual teams can create swift trust (Jarvenpaa/Leidner 1999). So, even more challenging than the motivational aspects of social capital are the cognitive aspects in ICT mediated communication. To carry out the social work of knowledge creation that involves the inter-personal negotiation of a shared understanding of things, people have to rely on face-to-face interactions (Nohria/Eccles 1992). That is because ICT lacks the richness to deliver all the needed tacit, non-verbal but "visual cues that are easily observable in face-to-face setting" (Andres 2002). This comprises facial expressions, gestures, tone of voices etc. (Putnam 2001). Accordingly, Nohria and Eccles (1992) argue that people who fulfil novel and imaginative work under conditions of ambiguity and uncertainty have to negotiate a shared understanding of the context, which cannot be done using electronic networks: "It crucially depends on face-to-face interaction" (Nohria/Eccles 1992). Consequently, we argue that ill-structured tasks cannot be fully governed by ICT. In fact, sufficient social structures (social capital) have to emerge first as a basis for people to use ICT to complement their face-to-face interactions (Nohria/Eccles 1992). Thus, VOs dealing with ill-structured tasks need more not less social interactions in a face-to-face mode: "This is because an extensive, deep, robust social infrastructure of relationships must exist so that those using the electronic media will truly understand what others are communicating to them." (Nohria/Eccles 1992)

Some scholars however argue for the need of trust and the need to improve ICT to overcome problems resulting from inter-firm distance and the ICT usage (e.g. Kaspar-Fuehrer/Ashkanasy 2001), rather than to question whether the pure play virtual organisation is the appropriate organisational form for complex collaboration, or how to design the virtual organisation in order to cater for the necessary social capital to emerge. We conclude that reliance on ICT-based communication poses critical challenges for the success of virtual network organisations due to the shortcomings in supporting complex interactions that are necessary to negotiate shared mental models and to establish rich social capital.

DISCUSSION

There is an imbalance between the task requirements of VOs (ill-structured, innovative tasks) and the organisational structures (virtual, volatile setups) and individual incentives (project in a temporary and precarious inter-organisational environment). While the concept of VO is outspoken about the goals – flexibility

and the combination of superior competencies – it remains vague about the preconditions of achieving a high performing project team within a limited timeframe. Ironically though, virtuality and volatility, two of the most promising characteristics of the virtual organisation related to the best of breed collaboration of firms, the flexible switching between market opportunities and the usage of ICT, are known as to be the most hampering factors for social capital to emerge (see Prusak/Cohen 2001, Nohria/Eccles 1992). And social capital, we argue, is a necessary prerequisite for the mastery of ill-structured tasks and the creation of new knowledge (Nahapiet/Goshal 1998). Social capital thus is a necessary complement to human capital: Individual competencies are embedded in social and institutional structures within companies and cannot be as easily transferred to a new context as other forms of capital. New social structures have to emerge in the inter-firm setting to provide the appropriate setting.

We summarize the inherent contradictions and challenges in the VO concept as we have identified them: generally, the task nature and its requirements are in contradiction with the organisational, particularly the structural characteristics of the virtual network organisation. Firstly, volatility in terms of short term projects and flexible switching contrasts the required individual incentives and motivation to invest in social relationships. Secondly, organisational virtuality challenges the formation of social capital due to diversity and cultural barriers. Finally, technological virtuality poses further challenges to this process due to a lack in media richness to cater for complex inter-personal interactions.

As these contradictions challenge the virtual network organisation as we have identified and characterized it in figure 2, some of the challenges can also be observed in the other two types. Since the ICT-enabled corporation relies on ICT for communication and collaboration (technological virtuality), it faces similar problems of achieving joint understanding over distances and transferring rich messages. The major difference though is that people belong to the same organisation, which poses less questions of diversity and allows for a central management of collaboration without inter-organisational barriers, although large global organizations tend to be increasingly diverse internally, which consequently can lead to the above mentioned challenges. The dynamic network organization on the other hand faces the diversity challenges of organizational virtuality that can be overcome by consequent co-location and regular face-to-face visits with less ICT-based communication. Regional networks are a good example for the latter type.

Investments in Social Capital as potential remedies

Whereas the initial structural propositions of the VO concept challenge the emergence of social capital, social capital, however, might at the same time be an answer to the incentive deficit and the collaborative competence challenge that VOs face. We argue that typical success factors of inter-organisational networks like a shared understanding of joint tasks, trust among the participants, and commitment and identification with the network need time to emerge and a perspective, that there is a good reason to make long-term investments in social capital. This discussion sheds new light on the concept of the pool as the basis for collaboration in the VO, which we have briefly introduced earlier. The VO in this sense is based on "an open-ended collection of prequalified partners that agree to form a pool of potential members of virtual organizations." (Goldman et al. 1995). This pool of participants provides the required long-term element in the VO for social capital to emerge. Managers in the VO have to acknowledge the relevance of social capital and to nurture its emergence and maintenance in the pool as a basis for an effective and successful setup of short-term projects. We thus recommend emphasizing this two-level pool and project structure, to which we refer as the VOp^2 – the VO with pool and project.

Social capital on the pool and the project level are interdependent and reinforce each other. On the pool level, social relationships facilitate information flows among individuals and firms and stabilize the rather fragile organizational arrangement. It will also have positive effects on the formation of projects in terms of finding and selecting project participants. Besides that, the facilitation of team work will be much easier with existing social relationships among individuals. New social capital then has to emerge quickly in the beginning of new projects (especially the relational and cognitive aspects) as it enables effective collaboration. Throughout the project lifecycle, social capital can be further strengthened to last beyond the project duration.

Since the concept of social capital is still a fairly new one to the organisational realm, further research has to be done on how to successfully facilitate and nurture social capital. And while some scholars have researched the role of social capital within organisations (see exemplarily Nahapiet, Goshal 1998; Leana, van Buren 1999), social capital in an inter-organisational context remains largely unaddressed. Drawing from recent management literature, the following aspects might be a starting point for how to deal with social capital within the VO: Firstly, opportunities for social capital investments have to be created by bringing people physically together in workshops, casual off-site events or even for longer periods of joint collocation, especially in the beginning of VO projects. As Prusak and Cohen state: "Social capital grows when team members meet face-to-face and work side-by-side." (2001). Secondly, in selecting project team members managers should capitalize on existing

social capital on the pool level and integrate those people into the team that have existing relationships with other employees in the cooperating companies. Thirdly, managers themselves have to display trustworthy and cooperative leadership behaviour that positively encourages and rewards relationship building and cooperative behaviour. Prusak and Cohen state that social capital investments cannot be done for the sake of appearances, because "human beings tend to know when someone is trying to manipulate" (2001). Leadership thus has to be honest and authentic. And finally, selected people might act as boundary spanners with the distinct role of establishing relationships, bringing people together and nurturing the social interaction process. We present table 2 to subsume some remedies according to the VO characteristics and challenges that we identified earlier.

Characteristics	**Challenges**	**Remedies**
Switching and short-term nature	Address lack of individual incentives and problems of limited loyalty	VOp^2 concept with emphasis on the pool as the required long-term element.
Best-of-breed: core competencies	Turn individual competencies into collaborative advantage.	Select pool partners with regard to collaborative competencies, strengthen collaborative competencies in projects.
Organisational virtuality	Deal Diversity, different organisational backgrounds, cultural differences.	Strong leadership approach with mediation focus, create collocation opportunities in the first phase of collaboration.
Ill-structured tasks	Achieve mutual understanding and consensus about the task.	Build common reference through group-level social capital; requires collocation as complement to distributed work.
Volatility and flexibility	Setup of effective project teams is a demanding task.	Nurture social capital in the pool as collaborative basis and extend it throughout the project(s).
Polycentrism and lack of hierarchy	Flexibility proposition and nature of innovative work require different management approach.	Nurture emergence of social structures and aim to create self-governing system based on appropriate social structures.
Technological virtuality	Distributed teams, lack of social contact and experiences. ICT-based work is challenging to govern.	Leadership approach, boundary spanner. Complement technology with social structures and face-to-face work.

Table 2: Characteristics of virtual network organisations, challenges and suggested remedies

CONCLUSION

Throughout this paper, we have taken a critical look at the promises and structural characteristics of VOs and contingent on the nature of innovation and ill-structured tasks have identified numerous challenges and inherent contradictions of the VO concept.

As remedies we have pointed out potential roles of social capital within the VO and accordingly have introduced the VOp^2, an organisational arrangement that provides a pool of potential partners from which project teams are recruited. The project represents the flexible component in the VO, whereas the pool is the required long-term component that is the basis for the necessary social capital to emerge. In this notion, VOs resemble sequential games rather then independent projects to provide the necessary motivational basis for investments in social structures. By including social capital in the VO discussion, we believe that the concept can gain credibility: the challenges are outspoken and specific measures are described that address these challenges, complementing virtuality and volatility with social capital. This is an issue that has to be addressed by managers responsible for VO ventures, as well as researchers that have an interest in understanding and enhancing the VO concept. However, further empirical research has to be done to specifically address the relationship between task requirements and organisational and social structures. We believe that social capital theory is useful do guide this research. Further research might comprise large scale studies examining social structures of existing virtual organisations, as well as in-depth case studies to research mechanisms for social capital facilitation in virtual organisation setups.

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ACKNOWLEDGEMENTS

This article is partly based on research undertaken in EC-funded research project DOMINO (IST-2000-29545), which aims at examining the management of dynamic network organizations.

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