A Structure of Roles within Virtual Organisations

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Abstract

Virtual organisations (VO) are often characterised by their loose structure, lack of hierarchy and their empowered geographically dispersed members. However, in this paper we claim that there is a certain structure present in a VO. This structure can be found in specific roles identified in two VO case studies. The roles are within knowledge teams around a specific knowledge field, who co-operate with other knowledge teams. A second role can be recognised in a management part of the VO. Management is seen as an architect role, where the content of the work is integrated into an overall picture, and a broker role, who mediates between the different parties involved. The last role contains the autonomic partners who are the sponsors of the VO. Furthermore, the power of the VO is not equally distributed among its members, but divided over groups that are part of the architect management role.

Keywords: Virtual Organisations, Business Partnerships and Virtual Organisation roles

1. Introduction

The notion of the virtual organisation (VO) is defined in many different ways, from a team within a single organisation, to a web company where different organisational partners combine resources and mainly work with information technology [cf. Lipnack & Stamps (1997)]. Literature about VOs is relatively new, although related literature in network theory, strategic alliances and joint ventures can be pointed out. Recently, the virtual organisation has become a popular research topic, but most research is still in an initial phase. Furthermore, a large part of the theory presented on VOs has a normative character, where the author tries to state guidelines for managing a VO and the kind of information system that could support the VO. On the other hand there is little empirical and longitudinal work performed on the structure of the VO [Ahuja and Carley (1999)] and how it develops over time. Furthermore, researchers with a technical background perform a relatively large amount of research on VOs, but less is seen in social science, and because of this, differences in research methodology, methods and even paradigms can be perceived. This study tries to contribute to VO literature in social science, where qualitative empirical data is used and the research has a longitudinal character (a VO is followed from its foundation to its end, in a period of three years, respectively one year).

There is no single acknowledged definition of a VO, however, a number of characteristics can be identified. The VO is a co-operation between several autonomous partners who work towards a common goal [Davidow & Malone (1992), Goldman, et al. (1995)]. VOs assemble...
themselves based on product uniqueness and cost-effectiveness regardless of company size, geographic location, computing environments or technologies deployed. Partners share skills, costs and competencies that collectively enable them to access global markets with solutions their members could not deliver individually [Hardwick & Bolton (1997)].

The definition of a VO that is used in this paper can be characterised by the following aspects: (a) a combination of several companies, (b) sharing knowledge and resources, (c) dispersion of members, (d) short duration time, (e) the organisation is based on mutual trust and (f) due to dispersion of members, information technology (IT) is used for communication and information distribution. The VO is a co-operation based on mutual trust, of several autonomous partners who share knowledge, skills and resources in order to accomplish a common goal in a certain period of time and of which the organisational members often are geographically dispersed [Bosch-Sijtsema (2001: 19)].

Most attention in VO research has been paid towards the external characteristics. Consequently, internal matters are hardly taken into account. This paper focuses on internal determinants of the VO. The VO often consists of contract members who work interactively with the VO and with their home-based organisational members. The contract members of the VO have several professional responsibilities and this could cause prioritisation, loyalty and motivational problems. The combination of skills, resources and knowledge within a VO can be seen as the collective means for achieving the member's goals. By combining strengths of autonomous partners, development of products, services or knowledge can be more effective, there is less risk for failure, and a more complete product for the customer can be produced [Goldman et al. (1995)]. Besides the advantages of a VO, i.e., flexibility, synergy, combination of strengths, skills and resources, it is also known that VOs are difficult to manage. Members work rather individual and there is hardly any control. Furthermore, from studies it was found that VO members are difficult to motivate, suffer from social loafing and absenteeism [Jarvenpaa (1998)]. The VO has several corporate boundaries that should be taken into account when discussing the organisation structure of a VO. These boundaries are time (limited time factor), space (geographically dispersed), structure (loose organisation structure), diversity (multi-disciplinary workforce, different experiences, values, routines and personality) and distribution of results and information [Bosch-Sijtsema (1997) (2001)]. These corporate boundaries make a VO rather flexible and innovative, however, on the other hand it is difficult to manage the organisation and to guide its members towards the final goal.

In literature, the VO is viewed as an organisation with a loose structure, empowered employees who have a large amount of decision-making power and there is hardly a hierarchy nor control [Goldman et al. (1995)]. Researchers have mentioned that the emergent structure of the VO will be a more amorphous web of connections, changing constantly in response to information processing needs [cf. Ahuja and Carley (1999)]. Some authors mention that the VO structure depends on the environment, the goal and the members working in the VO [cf. Sieber (1997)]. However, the organisational form is hardly mentioned in more detail and implicitly it is viewed as an organisation with little or no structure. According to Sandhoff [(1999)], virtualisation can on the one hand be viewed as dematerialization of jobs and organisational units, on the other hand it can turn into an organisation strategy for dynamically reconfigurable enterprises. The internal consistency (coherence) is threatened due to the creation of options for adaptation to the changing environment. This boundless organisation loses its distinction from the environment, a general characteristic of organisations [Sandhoff (1999)]. According to several authors, the problems of a loose structure of a VO can be partially overcome by IT [Bosch-Sijtsema and Bosch (1996)], mutual adjustment for co-ordination [cf. Mintzberg (1983)] and trust. The research question in the article is to investigate if the VO has a structure, and if so, what kind of structure does the VO have.
In this article we try to propose that the VO does have a certain structure, which can be viewed in the form of specific roles. The contribution of this paper is (a) to reflect on existing literature of VO, where it is stated that the organisation has a lack of hierarchy and a loose structure. (b) To add findings about how the structure of a VO could look like based on two case studies and (c) to confirm other literature that does mention the presence of hierarchy and structure in a VO. The remainder of the article is organised as follows. First the method applied for collecting empirical data is presented. Two case studies have been followed and they are discussed in section 2.1. From observations, interviews and questionnaires, several roles are induced who are presented in section 3. These roles can be viewed as the organisation structure of a VO. Section 4 discusses the contribution of the paper and future research is taken into account.

2. Methodology

The findings presented in the article are part of a research focussing on knowledge development in VOs. The structure of the VO is one item that is investigated further and presented in the article. The study is explorative and interpretive and the intention is to state propositions that can be validated and examined further in future research. In future, several other cases are examined and compared in order to generalise the research propositions. The methodology used is soft systems thinking [Checkland and Scholes (1999)]. In the research an understanding perspective is applied, where a subjective picture of reality is presented. The soft systems approach is related to human and organisational issues.

In the research a triangulation strategy is applied to collect data. Two in-depth case studies have been performed, where observations, interviews and questionnaires have been taken, furthermore, documentation has been taken into account. The researcher's role in the first case study was a participant observer and the case was followed for three years. In this period of time, interviews and questionnaires were taken twice and observations of all meetings were documented with help of extensive field notes. In the second case, an observer role was taken and the project was followed for one year. For validation of the qualitative data collected, two kinds of validation have been performed: (a) Triangulation of methods is aimed for where the qualitative investigation is completed and partly confirmed with the results of the quantitative investigation. (b) Respondent validation of the first case has been applied on a part of the data collected with help of team-building sessions with the members of the first case study. In qualitative research the validity of findings is often viewed as a problem with observational techniques [Adler and Adler (1994)]. Researchers are forced to rely on their own perceptions. In this research we have developed a conceptual framework in order to give insight in personal perceptions. The conceptual framework comprises VO literature, co-ordination mechanisms of VOs (i.e., role of management and the organisation structure), and knowledge development literature. This article presents findings within the topic of the structure of the VO. The qualitative data on this item has been coded and with help of the codes, the different roles were identified. Furthermore, the qualitative data was compared with the quantitative data in order to acknowledge certain aspects and to gain new insights. The topic of the roles and structure of a VO included data on how the organisation is perceived by its members, who is making the decisions, the role of management, the role of the autonomous partners in the VO and the development process of the VO.

In the questionnaire members were asked to answer rather personal questions about their communication with other members. Furthermore the questionnaire contained questions about leadership, goals, communication and contact between participants, participants and sponsors and participants and management. The questions about contact between participants were very personal (members mentioned by name), some of the questions were related to interaction, interest in specific areas, how well do you know the specific person, how much
contact do you prefer, and how much contribution do you get from this person (scale of 1-7 was used, where 1 is lowest and 7 highest). The questionnaire was partially used in order to increase communication and information distribution within both VOs. The questionnaire was used besides the qualitative interviews and observations, in order to gain some facts. Due to the fact that the sample N was very small (around N=20 for both case studies), only nonparametric analysis methods have been performed, furthermore, the variables in the questionnaire were only equally appearing interval scales and not confirmed ration scales (Bosch-Sijtsema 2001).

2.1 Case studies

The VO case studies are both in the energy industry and the VOs are registered in Sweden. The European energy market recently deregulated and competition between different utility companies increased. Due to these changes in the environment, many local energy distributors are vertically integrating to reduce costs. Furthermore, strategic alliances with complementary product and service suppliers are performed and relationships with individual industrial and business organisations are strengthened. An example of a co-operation within the utility industry is seen in Sweden, where Sydkraft AB (Utility provider) and IBM Utility have formed a joint venture, EnerSearch AB. The case studies involved in the research are both funded by EnerSearch AB. EnerSearch AB is a Swedish organisation who develops and executes research and application projects related to the utility industry. EnerSearch main mission is to support and facilitate research of international standard in the area of IT in energy systems, the facilitation of knowledge transfer from academia to industry and vice versa, and to build prototypes and demonstrators. The advantage of this kind of co-operation is that partners are still independent and only share resources to the point they agree.

2.1.1 ISES

The case study ISES (Information, Society, Energy, System), is centred around EnerSearch AB and supported by a number of utility companies as well as companies in related industries from Sweden and other European countries. The ISES project started in 1995 and ended in 1998. Its aim was to develop new knowledge on technological and strategic developments for energy systems and information exchange, i.e., two-way communication over the electricity network between customers and utility providers. In order to reach this goal, the ISES project was divided over nine subprojects, in which research was performed on technical applications (computer science), the customer side (organisation and market) and on the infrastructure (enabling technologies), in order to obtain a two-way communication means. All subprojects had a specific task, but co-operation was required in order to reach the common goal. The participants of ISES were geographically dispersed, not only within Sweden, but also in the Netherlands, France, Germany and USA. The organisation consisted of (a) PhD-students and consultants who conducted the research. (b) The supervisors who co-ordinated the work in the subprojects and communicated with the management. (c) The management, who integrated and co-ordinated the whole project and who communicated with the autonomous partners (one could view them as customers, since they paid for the research and requested certain issues to be addressed) and the outside environment. There were no clear roles, task descriptions or responsibilities. Members were supposed to deliver articles or a PhD thesis. The workforce fluctuated between 10 to 30 people depending on the development phase the project was in.

2.1.2 KEES

The KEES project (Karlshamn Energy Efficient System) involved work from several projects (partly based on results of ISES) of EnerSearch brought together with a clear application focus (no research was performed). The KEES project was a one year application project, where the idea was to instantiate and transfer available knowledge of the project partners with
respect to the application site, and to integrate this in order to come up with practical and implementable energy-efficiency measures and recommendations for the Karshamn municipality. The project was divided into several tasks who had a specific goal. These tasks were: (a) energy system simulation, (b) smart technology equipment, (c) energy savings in the built environment, (d) market investigations, and (e) system engineering and requirement specifications. The project had a similar structure as ISES, where dispersed PhD students and consultants did the work, supervisors co-ordinated the tasks and management co-ordinated and integrated the whole project. However, there was a clear description on the goal, tasks, and role of the members of the project.

3. Roles within the virtual organisation

In literature, little is mentioned about the internal structure of a VO. In literature, the structure is loose and fluctuates depending on the task, the environment and the management. However, there are a number of difficulties with such a loose structure. Within literature [cf. Sandhoff (1999)] and from the case studies it was found that members had difficulty in knowing their task, role and responsibility. Therefore, it might help management of a VO, to construct an idea of how VOs could work.

3.1 Management team

In VO literature, the structure of the organisation is hardly mentioned. The structure is loose and changes according to the tasks of the organisation [cf. Sieber (1997)]. Furthermore, the literature on VOs is implicitly based on the fact that individuals are empowered, where individuals all have equal rights in participation [cf. Goldman et al. (1995)]. The formal structure is replaced in VOs by loosely linked nodal points within the network [Sandhoff (1999)]. However, from the case studies examined, it was found that:

*Proposition 1*: the VO has a certain structure that is developing over time. The structure can consist of specific roles that develop in time.

*Proposition 2*: the organisation is based on small teams of members who shared specific knowledge and is not, as mentioned in literature, entirely based on empowered individuals,

In both cases (ISES and KEES), members who had a similar specific knowledge field co-operated in small teams. These teams had their own decision-making power within their specialised area. These teams could be called Knowledge Teams (KT). The KT can consist of individuals or, as viewed in both case studies, of a senior person(s) with several junior persons. Within these KT, members co-operate and have specific knowledge in a certain “technical or organisational” field. The junior members are performing the work, while the senior members try to integrate and combine the work of the juniors. Furthermore, the senior members communicate with other KTs and with the management.

The management of a VO is not to be compared to management in a traditional organisation. In the traditional organisation, there is no time limit for the existence of the organisation, some structure or hierarchy is available and roles and tasks are to some extent defined. Furthermore, members often have a location where they can meet (in the hallway, coffee room) and where a large part of the informal organisation is performed. Furthermore, the management has a central place and does not fluctuate between the members of the organisation, nor does it alter much in time. However, management in the VO is viewed as a person or group of persons who take a central place in the VO and who gain trust of other members in order to make decisions for the whole organisation. The management group can be part of the members of the VO. This group can alter or new groups can arise depending on the decisions that are to be made. In the studied cases, management had two responsibilities:
(a) guiding the content of the work, obtaining an overall picture of the work performed, (b) communicating, negotiating and mediating between the different members, autonomous partners involved and the environment of the VO. Within the case studies, separate members performed these tasks. In the case study ISES, there was a group of seniors (and one or two juniors) who tried to integrate and co-ordinate the research (content) of the VO. This group grew in the three years of existence and the group received decision-making power for guiding the content of the work in the VO. This group is called the architect group since they decided upon the architecture of overall structure of the work performed. The second task could be viewed as a broker task, where mediating and communicating between all participants was important. The broker was the CEO of both case studies.

The two roles mentioned above, were found from observations, interviews and from the questionnaire. In the questionnaire, the communication pattern of the members of ISES was investigated (members were asked how much communication they had with the other members, on a scale of 1-7, 1 = no and 7 = very much communication). In figure 1, the communication among the members of ISES project (in total there are 31 communication pairs between the members). Solid arrows reveal strong links, dotted arrows reveal weaker connections. The picture is based on ratings of how much each person contacts each other. It is clear that there is a group of four at the centre of the project who are strongly linked to each other, this is the leadership group of ISES (Driver & Bosch 1997). The leadership group in 1996 is viewed as the architect role. There is another group which is in 1996 not strongly linked, but more linked in 1998 (the circle consisting of social scientists), however, they are not strongly linked to the leadership group of 1996 (consisting of computer scientists and the broker). The broker (management role) is person A of subproject [6]. This picture supports the findings of group interaction in ISES, where in 1996 ISES as a whole was rated 2.7 and subprojects average rating was 3.7 (on a scale of 1-7, 1 = lowest, 7 = highest). In 1998, ISES as a whole was rated 3, and subprojects 3.8. However, preference for interaction in 1996 and 1998, was higher to an average of 5 for ISES as a whole and 5.4 for the subprojects.

Figure 1: Sociometric communication map of VO ISES in 1996 (left) and 1998 (right).
Where [1] A, means subproject 1, person A. The communication relations are: a dotted line is a moderate relationship (around 5), and a black line is a strong relationship (6, 7 in the questionnaire). The workforce fluctuated between 1996-1998.

The architect role
In the case of ISES two groups arose, one on the technical issues (in 1996 and 1998) and the development of the VO and one on social science issues (in 1998). These two groups are the squire and circle of figure 1 and are viewed as architect groups. The two groups communicated with each other, mainly with help of the broker, but the groups had their own
field of responsibility and content expertise. In the second case study, the management consisted of one person being the architect of the project, and one person being the broker. The KEES project was much smaller and only lasted a year, there might have been too little time to develop a central group for making decisions in the limited time of the project’s existence. However, group interaction was rated at an average of 3 for whole KEES, and for the subprojects 4.3. In the ISES project it took some time before members acknowledged the group who guided the content integration of the VO, this group needed to gain trust in order to make decisions. The group of architects did not have a central place in hierarchy in the organisation.

The broker role

Within the case studies, the broker role was a central hierarchical role and had an important task in communicating between all participants. Only the broker (who had decision-making power and who was the CEO) was central to the organisation and received the power to make decisions by all members of the VO (including autonomous partners). Within ISES and KEES the broker role was fulfilled by one person (for the time of existence of the VO), since it was felt as important that trust was build between the broker and the participants (including the customers). Members and customers needed to rely on the broker.

Proposition 3: The management of a VO is divided into an architect and a broker role. The roles can be fulfilled by one group, or by separate groups.

Although there was no explicit hierarchy in the case studies, the members of the VO did not have the same power for making decisions. In the case study of ISES the two groups (see figure 1) of seniors (and some juniors) decided on the content (and the integration) of the work performed. This corresponds to Sandhoff ([1999]), who states that actors in a VO have no equal participation rights as mentioned implicitly in literature. However, as in classical networks there are more or less strategic positions, which are not related to a central place in the organisation. The author states that loosely linked social circles of influential persons are formed, where some have an obvious position of power. The VO is illustrated as a power-asymmetrical network [Sandhoff (1999)]. The power-asymmetrical network of the VO is acknowledged in the case studies, however, within this network several roles can be identified. These roles are within the knowledge teams and the “management” (consisting of the architect groups and broker group). The management of the VO as discussed here, is fluctuating depending on the task and goal of what should be guided in the organisation.

Proposition 4: In VOs members do not have equal decision making powers, but the decision making power is based upon the roles that develop over time within the VO.

![Composite Knowledge Team (CKT)](image)

Figure 2: Composite Knowledge Team of a VO. Consisting of Knowledge Teams and Management (Broker/architect).

3.2 Complementary or competitor VO-structure

From literature it is known that VOs are build by autonomous partners who share their resources in order to develop a product or idea [Davidow and Malone (1991), Goldman et al. (1995)]. Figure 2, only comprises a part of the network where the actual work is performed.
In ISES, besides this network there was a larger network available of autonomic partners who financed the work and who provided equipment, knowledge about their own situation (market, and products) and who presented some of their current problems that they wanted to solve within the VO. Although it differs per VO what role the autonomic partners have, in ISES and KEES, they did not participate in the actual work or research, they were merely viewed as customers of the internal VO.

The VO can be a complementary structure, which is often referred to in literature, or it can have a competitor structure. The complementary structure comprises autonomic partners who combine their competencies and try to define new products or knowledge. The competitor structure includes competitors from several countries who try to explore new ideas, applications, develop knowledge or who try to come towards standardisation in their field. The case studies were mainly based on a pre-competitor structure. The autonomic partners of the cases were mostly utility providers of different countries, who would in future, become competitors (in 1996, deregulation of the energy market had not yet started in all European countries). Their aim, with financing and working with the VO cases, was to explore the new market situation, increase knowledge on new services and products and receive information about the final electricity customer. The deregulation of the utility industry included a very difficult time for the utility providers, since price wars would emerge and cost savings were necessary. For this reason, little effort would be performed in future products and ideas, but all energy of the organisation was in the field of re-organising the company and becoming more cost effective. In the VO cases, the utility providers could make use of research and ideas they would not be able to perform by themselves in the near future.

Besides the utility providers (pre-competitors), there were also several other autonomic members who worked in the utility related industry and members from the municipalities where the projects were registered (they did not have a single location where members could meet). These members contributed with complementary knowledge on rather specific fields. The utility related industrial partners were interested in knowledge about the new market, new products and the final electricity customer (the wishes of the final customer influenced their products indirectly). The municipality related partners, were more interested in developing and promoting the local region.

![Figure 3: Competitive Virtual Organisation Structure](image)

In the case of ISES and KEES, the autonomic partners could be viewed as customers. They stated several problems they incorporated and requested ideas on these problems in return for support (support in finances, information, equipment and some placed participants in the VOs). Also within other VOs, customers can be part of the structure. The customers are often part of a larger network, where several smaller VOs can participate. Hedberg discusses the imaginary organisation as the blueprint upon which the VO is built [Hedberg et al. (1994)]. The VO in this respect is part of a large (imaginary) network. The customers of EnerSearch (the organisation who initiated the investigated case studies), were also part in other virtual projects within rather specific fields. In order to receive a clearer picture of the complete
virtual organisation network a competitive virtual organisation structure is presented in the figure 3.

In the case study of ISES, the members selected to work in the VO were mostly part of the personal network of the broker. The broker initiated both case studies and hired the members of the network. The KEES project was a successor of the ISES project, although it had a different scope. A large number of the senior members of ISES (mainly those who were part of the architect group), also joined of the KEES project. The senior members often choose the junior members who performed the work. This was mainly done because the senior had a contact network in his/her own specialisation field. The personal network of the broker consisted of work related members, friends, and earlier project members (members who had been co-operated with earlier). The personal network of the broker was used for both finding members of the KT (mainly the senior members, who selected juniors), but also for finding new customers (financial sponsors). In strategic alliance literature, the social structure (ties) of firms are closely intertwined with strategic action in the development of a strategic network [Gulati (1999)]. Gulati mentions that social structures within which economic actors are embedded can influence their subsequent actions. Furthermore, the distinct social structure patterns shape the flow of information in exchange relations within markets.

<table>
<thead>
<tr>
<th>VO roles</th>
<th>Role</th>
<th>Members</th>
<th>Characteristic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge team</td>
<td>Specific goal in their expert field</td>
<td>Senior-junior</td>
<td>Performing the work in the VO in a certain knowledge domain.</td>
</tr>
<tr>
<td>Architect role (management)</td>
<td>Guiding the content and integration of the work</td>
<td>Fluctuating group of members</td>
<td>Gaining trust amongst members for making decisions</td>
</tr>
<tr>
<td>Broker role (management)</td>
<td>Mediating between participants and external environment</td>
<td>Role fulfilled by individual or stable group (does not fluctuate)</td>
<td>Gaining trust amongst members for communication and information distribution</td>
</tr>
<tr>
<td>Customer role</td>
<td>Supplying equipment, money, information on market, product and organisation.</td>
<td>Representator of the customer organisation</td>
<td>Important to understand the expectations, role and benefits of the co-operation</td>
</tr>
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</table>

4. Conclusions

There is little literature available on empirical research of VO development and structure. In this article report is made on observations of two longitudinal in-depth case studies. In these cases, it was found that the VO exists of knowledge teams, who combine specific knowledge and together form a VO with other KTs. It became clear that the VO does not only exist of individuals with specific knowledge who co-operate towards a common denominator. Furthermore, the loose structure, as mentioned in literature as one of the main characteristics of a VO, might not always be as loose as stated. A loose structure makes it difficult to coordinate and control the work performed, and affects isolation, social loafing and absenteeism of VO members. From the cases, it was found that individual members tried to create knowledge teams in their own specialist field, including seniors and junior members. These KTs add up to a composite knowledge team. Furthermore, it was found that not all members had an equal right in decision-making within the organisation, which is also discussed by Sandhoff [(1999)]. Ahuja and Carley [(1999)] found in their study that from an authority standpoint, the VO may be decentralised and non-hierarchical, however, from a communication standpoint they may still be hierarchical and somewhat centralised. These
authors study communication patterns in research virtual organisations and found a degree of hierarchy, centralisation and hierarchical levels in communication between members. This study confirms these observations by showing that there are hierarchical communication structures in the case studies (between juniors versus seniors and between broker versus autonomous partners).

In the investigated case studies, groups arose over time that dealt with decisions on the content integration or VO-architecture. These groups could be viewed as the management of the VO, who alters and fluctuates depending on the task and goal and on the time limit of the organisation. The “management” role of the VO consists of two aspects, i.e., the broker (mediating between all members internal and external) and architect role. For practical matters and trust-related issues, the broker role is more constant or stable than the architect role is. Furthermore, these two roles do not have to be fulfilled by the same individual or group of people. Finally there is the role of the autonomous partners or the customer of the VO. The customer is part of the decision-making process towards the final goal of the VO. In the case studies, the customers mainly communicated with the broker. The role of the customer in ISES was very spread to supplying equipment, presenting knowledge about the market and customers, discussions on work performed or only observing the work performed in the VO. For the broker of the VO, it is important that the role of the customer is explicitly defined, so that the broker can communicate this to the VO members.

The finding presented here could be applied too several aspects. (a) Mapping the communication patterns between VO members might evaluate the interaction and communication structure between the VO members. It is possible to view places where little interaction is performed and where strong and weak links between members are placed (this is important for knowledge management, when members leave the organisation, strong communication links suddenly change). (b) By specifying roles within the VO, the participants might be more involved and responsibility and decision-making power become more clear to the members.

There are a number of aspects interesting for future research, i.e., the role of the customers. Questions that could be stated here are what kind of knowledge do customers receive, and how can they use this within their own organisation. Furthermore, in the case studies it was found that roles were not defined or implicitly available amongst members (mainly senior members). The unclearness of roles in a VO, offered confusion and difficulty in knowing how much responsibility and decision-making power a member has in a VO. It was found that expectations of members were of importance to the success of the VO. Members had different expectations, i.e., members with a rather detailed and high expectation of the VO, often did not see this expectation fulfilled in the long run. These members became dissatisfied and some left the VO. However, members with an vaguely described and low expectation were more satisfied with their own work and the results of the VO. In future research, the expectations of members within VOs are related to roles, the organisation and the task and a relation to performance and satisfaction of the work are taken into account. A second theme of discussion, will be the co-ordination mechanism of a VO. How can a VO be co-ordinated in order to reach the final goal. Are the co-ordination mechanisms [e.g., Mintzberg (1983)] that we know from today’s literature, operational for the VO? These co-ordination mechanisms are mainly based on traditional organisations, where the workforce does not fluctuate heavily, where the organisation has a long term life span and where members are not all geographically dispersed. The different roles identified in this paper, might help to understand and manage the VO, however, several mechanisms are needed in order to co-ordinate these different roles.

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