Think global, act global

Towards a model for building virtual communities of practice for European research projects

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for European research projects

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TNO Built Environment & Geosciences: Innovation & Environment, Delft
SCORE! Project
Supervisors: Dr. A. Tukker & Drs. S.B. Emmert
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Universiteit Twente
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SCORE! Sustainable Consumption Research Exchange

PREFACE

The best preparation for tomorrow is doing your best today (H. Jackson Brown Jr.)

Internet and ICT in general have always been a passion of mine. That was the reason I got my BSc. in Communication & Multimedia Design. In the four years I attained the school of higher professional education, I did several very interesting projects. Designing and developing educational applications were my favourites. For secondary school children I developed interactive course material for a subject about culture and art. For primary school children with visual impairments I made an application where they had to recognize different sounds that are common to be heard in and around the house. These are just two examples of projects I have done. In a later stage, I developed more interest in doing research about different kinds of multimedia applications, in particular for educational purposes. My graduation thesis was called 'The Future of Interactive Multimedia Learning Environments'.

During the courses I followed at the University of Twente, which were more scientific of nature, I developed added interest in applying ICT to organizations and to society in general. This was mainly due to the courses 'ICT & Organizations', and 'ICT, Society & Policy'. Especially the course ICT & Organizations helped me form the interest I have now in doing research about virtual communities of practice. Also my interest for interface and interaction design, which developed further during both studies, formed a good foundation to conduct a thesis about this topic.

When I almost finished the 'New Media, Research and Design' track at the University of Twente, I needed to find a good place to graduate. Fortunately, this place turned out to be available at the right moment. The organization where I could work on my thesis was TNO (i.e. the Netherlands organization for applied scientific research), business unit: 'Built Environment & Geosciences', Delft, the Netherlands. Dr. A. Tukker and Drs. S.B. Emmert, who are also my supervisors during the timeframe of this thesis, indicated that they wanted something like a virtual community for the SCORE! project, which they are both managing. The main question formulated by them was how to do that successfully, and how to get their community motivated to work online. This seemed to be an excellent challenge for me.

There are several motivations why this thesis is useful. These motivations can be read in the first chapter of this report. A slightly personal motivation to write this thesis is that virtual communities of practice are a rather new phenomenon, which makes it very interesting to investigate. On the other hand, this makes it also a bit harder. During the development of the theoretical framework I realized that the virtual community of practice concept is not a concrete defined one. It is studied from different perspectives, each with its own interpretations. Nonetheless, these issues challenged me to work hard on this thesis for the past six months.

This result was never possible without the help of others. That is why I would like to take this opportunity to thank some people. First and foremost I would like to thank Dr. A. Tukker and Drs. S.B. Emmert for giving me the opportunity to work in an inspiring environment on an exciting case. I have learned a lot during these months and I am very grateful for that. Not only have I learned much about the subject I was writing about, but also practical things like how to approach a difficult to reach target group for research, practical insights in how large research organizations are functioning, and what it is like to run a European research project. Besides that, they have both stimulated me in more critical thinking. I would like to say that I have experienced our collaboration as very pleasant.

Secondly, I would like to thank Dr. S.A. de Vries, who was my mentor during the last months. He always had time for me and was very helpful. During our meetings he always talked about this thesis in a very enthusiastic way and his comments were always very inspiring, which gave me a lot of confidence to work on this thesis. He also challenged me to think more about certain issues which allowed me to lift this thesis to a higher level. I have experienced our collaboration as very fruitful.

Thirdly, I would like to thank the SCORE! community for participating in interviews with me during the SCORE! workshop in Paris, France. The respondents who filled in the questionnaire that were distributed over there deserve many thanks as well. They have provided insights that really helped me writing this thesis. Besides that, it was also very rewarding to actually meet the SCORE! community in real-life. It is a really fun, pleasant, and enthusiastic group of people.

Fourthly, I would like to thank my colleagues at TNO for filling in the digital questionnaire that was send to them. Special thanks go out to my direct colleagues from division 4-West and 5-West. I would like to thank them for participating with me in a cluster experiment, which was very useful for my thesis. I would like to thank Marian Plugge as well, for giving me some useful editorial advice at the end of this journey. I would also like to thank the colleagues that did not participate in any thesis related activity, but who made the atmosphere to work in great. Besides my direct colleagues, I would furthermore like to thank two indirect colleagues from division 4-East who could give me some practical advice about virtual communities for European research projects.

Last but not least I would like to thank my girlfriend for her interest and support during the past six months. She helped me out where she could, and I owe her many thanks for that. My friends and family also need to be mentioned, because they have always supported me very much. Thank you all!

To conclude, I hope you will find my thesis report interesting to read and that you can learn a lot about virtual communities of practice in a European research context. Maybe it can even make you enthusiastic to enter the world of virtual communities yourself!

Delft, August 2007

Jurjen Jansen

EXECUTIVE SUMMARY

The network is the computer (John Cage)

This thesis report deals with virtual communities of practice (i.e. VCoPs) for European research projects. The purpose of VCoPs is getting more substance now the world is becoming more networked (van Dijk, 2006). A VCoP in the context of a European research project is an aggregation of (self-)selected project partners who participate in a collection of activities which are related to the research project. The project partners function as an interdependent network (at least) during the timeframe of the research project. The interaction is at least partially supported and/or mediated by technology, and the research partners have the shared goals of bringing the research project to a successful end in an effective and efficient way, and further the practice in the specific research domain, which is supported by protocols and norms.

The research question that is central to this thesis is *"which factors determine the success of a virtual community of practice for European research projects?"*

There are two main issues covered in this thesis report. The primary goals of this thesis were to develop a VCoP process model, and a VCoP factor model. Both issues describe the theoretical part of this thesis. Besides the theoretical part, this thesis also dealt with a practical case. The theoretical results were applied to the SCORE! project, which is a European research project around 'sustainable consumption and production'. The project managers of SCORE! liked to initiate a VCoP for their project, but were not sure how to do that successfully.

The character of this thesis is a broad explorative analysis. Various methodologies have been used to find an answer to the main research question, the sub questions that were derived from the main research question and the hypotheses, which are described later on.

First of all, an extensive literature review was conducted which was concerned with theories about communities of practice, virtual communities, VCoPs, knowledge management, and human-computer interaction. The results from the literature review are the fundament of this thesis report. The literature review also proved to be helpful constructing the VCoP process model. The VCoP process model describes the phases a VCoP for European research projects can be in, and explains the steps that need to be executed in order to set up such a VCoP. The following nine stages could be identified which explain the process of initiating the idea to form a VCoP to actually launch it:

- The identification stage
- The inspection stage
- The decision stage
- The conceptual design stage
- The prototyping stage
- The pre-launch stage
- The formative evaluation stage
- The launch and establishment stage
- The summative evaluation stage

The literature review furthermore provided factors that determine the success of VCoPs. However, these factors needed to be tested, in order to make sure whether they also determine the success of VCoPs for European research projects. In order to do so, a digital survey was conducted with researchers from TNO. The following eight factors were proved to be critical success factors:

- Better availability of knowledge
- Being constantly up-to-date
- Quicker problem solving
- Reducing time and costs
- More possibilities to learn
- Physical meetings
- Characteristics of the VCoP
- Better project management

Moreover, the digital survey assessed some general considerations. VCoPs for European research projects are only useful when researchers themselves see value in it. Fortunately, almost all researchers that filled in the questionnaire stated that a VCoP will have added value to European research projects. A large percentage also thinks that it is a realistic thing to do. The question remains if people are going to use it when it is there. Over two-thirds of the researchers think that project partners will use the VCoP once it is being launched.

A cluster experiment was used to assess the underlying hypotheses:

H1: *The influence of the factors, which determine the success of virtual communities of practice for European research projects, depends on the size of the community*

H2: *The influence of the factors, which determine the success of virtual communities of practice for European research projects, depends on the phase the community is in*

The results of the cluster experiment are useful to make the success factors more specific applicable. It also lead to a deeper understanding of why some factors are critical success factors, and why some factors are rated to be of unimportance to such VCoPs.

The secondary objective of this thesis was to develop a VCoP for the SCORE! project. Besides using the theoretical results, some research with the SCORE! community itself was necessary as well. Some interviews were conducted and a survey was spread at the SCORE! workshop in Paris, France. Furthermore, three field tests were conducted to test video conferencing applications. These methodologies gave useful insights how to construct the SCORE! VCoP, and how to actually build it.

Key words: community of practice, virtual community, virtual community of practice, European research projects, success factors, process model, factor model.

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1 INTRODUCTION

We can be knowledgeable with other men's knowledge, but we can not be wise with other men's wisdom (Michel de Montainge)

This master thesis report is written as a part of the master study 'Applied Communication Science' at the University of Twente, the Netherlands. The central theme of this thesis is the virtual community of practice (further referred to as VCoP).

A communication trend, which shows that social interaction between friends on the internet is becoming an intrinsic part of everyday life, can be discovered. However, could this trend also proceed to research projects as well? The context of the thesis lies within European research projects. European research projects are projects, which are initiated and executed by researchers from multiple European countries. The definition of the problem is the outline for the research approach. The problem definition is formulated as follows: *which factors determine the success of a virtual community of practice for European research projects?*

The character of this research is a broad, explorative analysis. The emphasis is on the construction of two models. The first model that is going to be addressed is the VCoP process model. The VCoP process model is a model that describes the steps that need to be conducted, in order to set up a successful VCoP for European research projects. The second model is the VCoP factor model. This model includes the factors that influence the success of a VCoP for European research projects. The factor model provides directions and recommendations what to take into account in a VCoP for European research projects. Both models should provide a theoretical foundation to build a successful VCoP for European research projects.

Before these issues are addressed, the research design (see figure 1.1) is presented first. In this paragraph, the project framework is offered, in order to understand the scope of the problem this thesis deals with. This is followed by the research objectives. In the third section, the relevance and motivation of this thesis is given. In the fourth section, the research model is highlighted. The research questions are addressed in the fifth section. This chapter concludes by outlining the structure of this report.

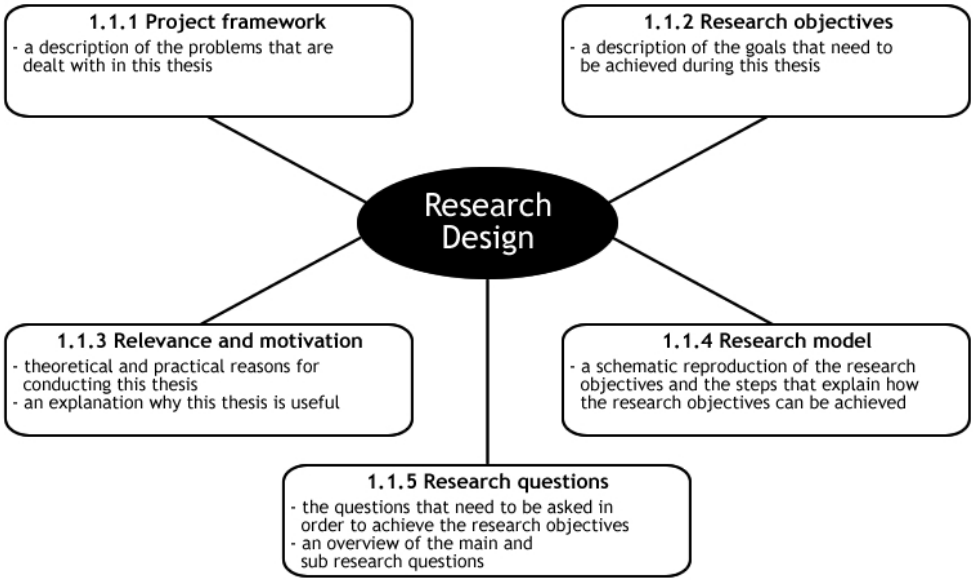

Figure 1.1: Research design

1.1 Research design

When doing research, a research design needs to be constructed first. According to Verschuren and Doorewaard (2000) a research design consist of two groups of activities. First, the 'conceptual research design' is needed. The goal of the conceptual research design is to understand what objectives are tried to be achieved during the research process. The second group of activity is called the 'technical research design'. In this group of activity it is tried to identify how these objectives are going to be realized.

The conceptual research design consists out of four components. It is important to understand the research objectives first (see section 1.1.2). The research objectives can be distilled from a (set of) problem(s). The set of problems is what Verschuren and Doorewaard (2000) call 'the project framework'. The project framework can be found in section 1.1.1. The next action is to develop the research model. In the research model, a schematic reproduction of the research objectives and the global steps how to achieve these objectives are presented (see section 1.1.4). This is continued by transforming the problems and/or objectives into research questions (see section 1.1.5). The last component of the conceptual research design is to determine the definitions. The definitions that come across in this report need to be clarified. This makes the contents of the report better outlined (Verschuren & Doorewaard, 2000). This is not an isolated step and will therefore be performed during the creation of the theoretical framework.

The technical research design consists of three components. The first thing to determine is what kind of research material is needed in order to answer the research questions. This step is integrated in the description of the research model. Then it is time to set up a research strategy. The research strategy holds how research material is going to be gathered and processed, in order to find an answer to the research questions. The research strategy can also be extracted from the research model. The last step is to plan the activities. This step can be found in the research proposal made in advance of this thesis, but is not presented within this report.

A step that is not mentioned by Verschuren and Doorewaard (2000) is including the relevance and motivation for doing research. This is an important point to consider, because it makes clear to what extend the results can contribute to existing literature. This can be found in section 1.1.3.

1.1.1 Project framework

The project framework carefully describes the problems that are dealt with in this thesis. Currently, more and more European research projects are initiated. These projects often have a limited time span. After the official end of a project, the community which is formed around the project often falls apart. This is unfortunate considering the network of people that is built up during the project. But also the fact that knowledge and experiences gained during the project are lost is regrettable.

Most European research projects are supported by a web site, which is used as the main port for general information and communication. However, these web sites are often limited in their use (i.e. there is little room for interaction). A project web site is often accompanied by a discussion forum, but more than that is scarce. Then again, discussion forums are seldom used and are often unsuccessful. This means that, besides keeping the community together, it is important to provide a well designed virtual place for interaction as well (i.e. a VCoP).

During this thesis it is tried to make a case for sustaining a VCoP for European research projects, but moreover to make them successful. The question is how such a thing can be arranged? In current literature there are no direct answers that could solve this issue.

1.1.2 Research objectives

The research objectives can also be articulated as the goals that need to be achieved during the time span of this thesis. The research objectives need to be aligned with the project framework described in the previous section. According to Verschuren and Doorewaard (2000) the research objectives need to be formulated in an adequate way. By this they mean that the research objectives need to be useful, feasible, clear and information rich.

There are two types of research, namely: theory directed, and practical directed research (Verschuren & Doorewaard, 2000). The strategy used in this thesis is a combination of the two.

There can be identified two primary research objectives in this thesis related to the theoretical part. The first objective is to develop a VCoP process model. The VCoP process model contains the steps that need to be conducted, in order to develop a VCoP for European research projects. The VCoP process model gives recommendations and directions how to set up a VCoP for European research projects. However, it might still be unclear which factors could influence this process and the VCoP in general. Therefore, the other primary theoretical objective is to develop a VCoP factor model. The VCoP factor model explains the factors that are influential to the success of a VCoP for European research projects.

Two other primary research objectives are related to the practical part of this thesis. The case that is used in this thesis is the SCORE! project. SCORE! is a European research project, which is explained more carefully in chapter three. The first practical objective is to give the project managers of SCORE! an advice how to set up a VCoP for their project. The other objective is to actually build a VCoP for the SCORE! project.

1.1.3 Relevance and motivation of research

The relevance and motivation of doing research about this phenomenon can also be categorized in theoretical and practical parts. The VCoP literature to date is slightly instable and rather complex. This is mainly due to rapid (technical) innovations, the multidimensional nature of studies (Leimeister, Sidiras & Krcmar, 2004), and the diversity of VCoPs. Current studies often investigate VCoPs from an organizational perspective, with specific links to business and commercial sectors. Others are investigating it from an e-learning perspective. There are almost no studies that apply the VCoP concept to a (European) research perspective. This is the first theoretical reason why this kind of research is necessary.

As described in the project framework, (European) research communities often vanish when the project is finished. This causes the loss of valuable experiences and knowledge, but also the loss of entire networks. There are many papers written about VCoPs, but they never seem to address this problem. Because societies and organizations are constructed in an ever growing networked way (van Dijk, 2006), there is a strong possibility that VCoPs will be applied more often in the (near) future. Therefore, this is a relevant point to consider.

The other theoretical reasons are that there are no explicit scientific articles or books that give grounded directions or guidelines how to set up a VCoP in a successful way, especially considering (European) research projects. There are however some professional one-size-fits-all guidelines (Dubé, Bourhis & Jacob, 2006), but because of varying characteristics of different VCoPs, these do not always apply. This is what Kollock (1996) is mentioning as well. Building a VCoP is fundamentally different than just writing computer code. Code does not write back and code does not respond strategically to ones actions. There are no step-by-step procedures that can be followed to get a specific result. Leimeister and Krcmar (2004) are also stressing that typical success factors for VCoPs are scarce in literature. It is therefore important to understand which factors are influencing the success of a VCoP for European research projects. These findings can contribute to existing literature.

The relevance of this thesis is theoretical, but it also has some practical relevance. The results of this thesis can be used by people who want to develop VCoPs for European research projects. The results are applied to the SCORE! project as well. The project managers of SCORE! are realizing the potential problems described in the project framework. These and other issues around SCORE! are tried to be solved by introducing a VCoP.

1.1.4 Research model

In this section, a schematic reproduction of the research objectives and the global steps how to achieve the objectives are presented. The boxes with a black line represent the theoretical part, whereas the boxes with a blue line represent the practical part. This is done to make a distinction between the two parts.

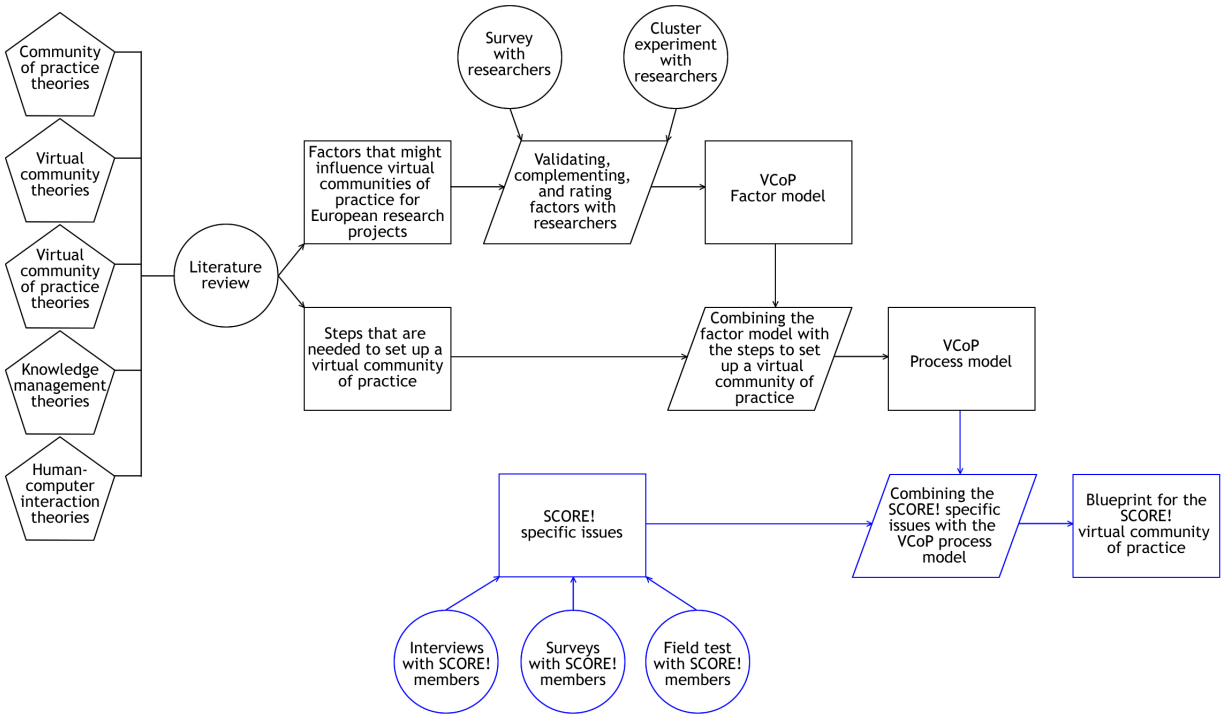

Figure 1.2: Research model

The theoretical part of the research model can be explained as follows: analyzing the issues with literature about community of practice, virtual community, VCoP, knowledge management, and human-computer interaction theories, lead to a set of factors that might influence the success of a VCoP for European research projects. Then the factors are validated, complemented, and rated by researchers from TNO. This is done by conducting a cluster experiment, and by sending out a digital survey. The data is gathered and carefully analyzed, and results in the VCoP factor model. By doing a literature review, also the steps how to set up a VCoP are derived. Combining the steps that need to be followed to set up a VCoP, with the VCoP factor model, results in the VCoP process model.

The practical part can be described as follows: by conducting interviews, distributing questionnaires, and by doing field tests with the SCORE! community, SCORE! specific issues are made clear. When combining these issues with the VCoP process model, an advice can be given how to set up the SCORE! VCoP. A blue print by which the VCoP can be developed is the result.

1.1.5 Research questions

In order to gain knowledge that is useful and necessary to meet the research objectives, the research questions need to be formulated. According to Verschuren and Doorewaard (2000), research questions have to meet two criteria. First, research questions need to be formulated in efficient ways (i.e. they need to contribute to the research objectives). Second, research questions need to have a clear direction (i.e. they need to make understandable what needs to be researched).

Based on the project framework and the research objectives, the main research question of this thesis can be formulated as follows:

- *Which factors determine the success of a virtual community of practice for European research projects?*

In order to find an answer to the main research question, it needs to be divided in several sub questions. Sub question one is related to the theoretical framework. The first sub question is necessary, in order to grasp the abstract term 'virtual community of practice'.

- **Sub question 1:** *What theoretical concepts can be obtained from current literature that will explain the virtual community of practice concept?*

The second sub question deals with the issue if VCoPs for European research projects are feasible. When researchers do like the idea of having a VCoP for their research projects there can be made a case for initiating such initiatives.

- **Sub question 2:** *How do researchers perceive the idea to work with a virtual community of practice in European research projects?*

Sub question three is related to the VCoP process model. This question is fruitful to ask, in order to find out the steps that are needed to set up a VCoP.

- **Sub question 3:** *Which practical concepts can be obtained from current literature that will explain the steps that need to be conducted, in order to set up a virtual community of practice?*

Sub questions four and five are related to the VCoP factor model. These two sub questions are relevant to ask for different reasons. Sub question four is needed, in order to understand which factors are influencing the success of a VCoP in general. Without this information, it is difficult to define the factors that will influence the success of VCoPs for European research projects, which is addressed in sub question five. Sub question five is also used to identify the critical success factors for such VCoPs.

- **Sub question 4:** *Which factors determine the success of a virtual community of practice?*

- **Sub question 5:** *Which factors, which determine the success of a virtual community of practice, can be attributed to virtual communities of practice for European research projects?*

Sub question six deals with the tools that can be implemented in a VCoP. In order to give a practical advice how to set up a VCoP for European research projects, it is advantageous to understand what kind of technology is available.

- **Sub question 6:** *Which tools can be identified, that can be integrated in a virtual community of practice for European research projects?*

The last sub question deals with the practical part of this thesis. When setting up a VCoP it is important to do that according to the needs of the actual users, in this case the SCORE! community. It is important to understand what drives them to contribute to the project, what they would like to do within a VCoP, and most importantly, if they like the idea that a VCoP will be introduced to the SCORE! project.

- **Sub question 7:** *Which SCORE! specific issues can be identified, that are important when setting up a project specific virtual community of practice?*

The main research question and the sub questions are going to be answered with various methodologies. The methodologies that are used can be found in chapter four.

1.2 Thesis structure

The structure of this report (see figure 1.3) unfolds as follows. The theoretical framework is presented after this chapter. In the third chapter the practical case used in this thesis (i.e. SCORE!) is addressed. This is followed by highlighting the research methodologies. The report continues with chapter five, where the research results are presented. In chapter six it is described how the VCoP for SCORE! is set up. The report then holds the conclusions and recommendations of this thesis. The conclusive chapter, chapter eight, is used for discussion.

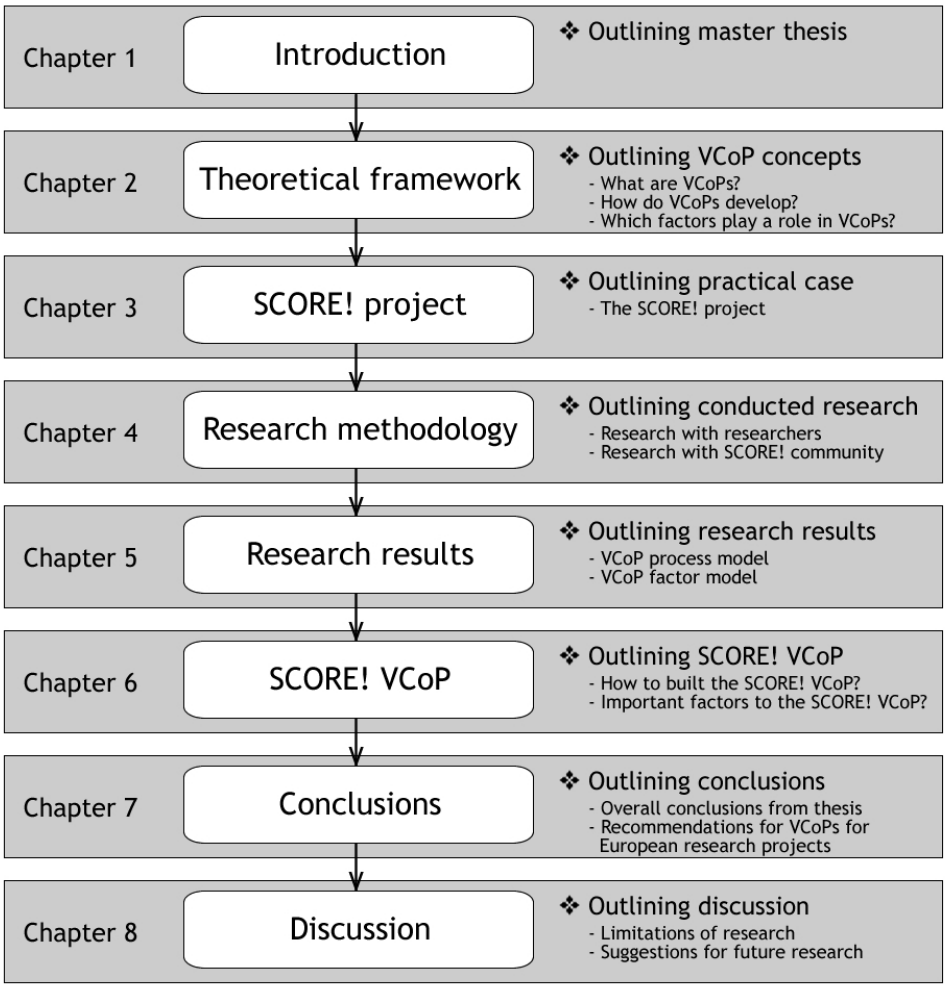

Figure 1.3: Structure of contents

2 VIRTUAL COMMUNITIES OF PRACTICE

See one promontory, one mountain, one sea, one river, and see all (Socrates)

In this chapter, the theoretical framework is presented. The focus of the theoretical framework is on virtual communities of practice (i.e. VCoPs). The theoretical framework is necessary, in order to develop a foundation about what is going to be researched. Moreover, it is needed to find an answer to the main research question.

The theoretical framework can be divided in three elements (see figure 2.1). In the first element, a description is given what VCoPs are. The VCoP concept is built on two components, namely: communities of practice (further referred to as CoPs); and virtual communities. In order to create a better understanding of VCoPs, both components are described first in this paragraph. The second element deals with the development processes of VCoPs. In this paragraph, the pre-conditions that are necessary before introducing a VCoP, the steps that are needed to create a VCoP, and the phases a VCoP can be in, are described. The third and last element describes the factors that play a role in VCoP success. The factors are addressed according to the typology of McDermott (2000). This means that the factors are divided in the following four constructs: management challenges; community challenges; personal challenges; and technical challenges.

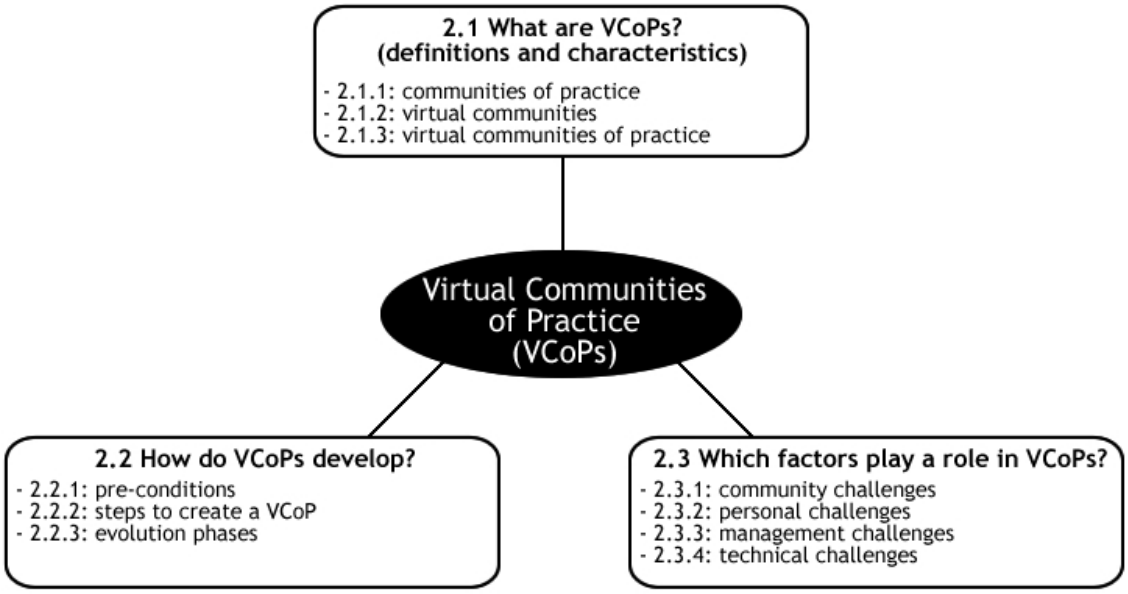

Figure 2.1: Structure of theoretical framework

2.1 What are virtual communities of practice?

In this paragraph, the VCoP concept is highlighted. In order to make the VCoP concept better understandable, the CoP and the virtual community concept are addressed first. This paragraph is necessary to solve sub question one *(i.e. what theoretical concepts can be obtained from current literature that will explain the virtual community of practice concept?)*. The questions that could be derived from this sub question are addressed in the individual sections.

2.1.1 Communities of practice

"We all belong to communities of practice. At home, at work, at school, in our hobbies – we belong to several communities of practice at any given time. And the communities of practice to which we belong change the courses of our lives. In fact, communities of practice are everywhere" (Wenger, 1998, p. 6).

This is how Wenger (1998) introduces the notion of communities of practice. Everybody may recognize something of this definition in everyday life. However, it may not be always clear what CoPs are. In this section an answer to the following question is given: "*what are communities of practice, and what characterizes them?*" First the definition and characteristics of CoPs are described. This section ends by presenting the conclusions about CoPs.

Defining communities of practice and its characteristics

People are constantly engaged in the pursuit of different enterprises. In order to achieve these enterprises people have to interact with each other. By interaction people learn. This collective learning furthermore results in the forming of social relationships. People who are persuading joint enterprises (i.e. a shared domain of interest) can form a community. These communities share ideas, find solutions, and build innovations over an extended period of time. They do so by participating in an active manner. Wenger (1998) calls these types of communities, 'communities of practice'.

The term 'community of practice' was first introduced in 1991 by Etienne Wenger and Jean Lave. They investigated apprenticeship in various types of communities. As a result from their investigation, they found 'legitimate peripheral participation' as an important aspect of effective learning. By this finding they could broaden the traditional concept of expert-to-apprentice relationships to one of changing participation and identity transformation in a CoP (Wenger, 1998). The words 'legitimate' and 'participation' refer to the belongingness of the community. The combination of 'peripheral' and 'participation' is referring to a sense of place and identity in the community (Hildreth, Kimble & Wright, 2000). In short, it could be said that a CoP is a group of people who are informally bound together by shared expertise and passion for a joint enterprise (Wenger & Snyder, 2000).

CoPs were often initiated by people who are connected with each other in shared areas (e.g. neighbourhoods). These CoPs existed for centuries and relied much on physical (i.e. face-to-face) meetings (Wenger, McDermott & Snyder, 2002b). Now-a-days, society and organizations are becoming more networked in nature (van Dijk, 2006). This means that it is not always feasible to do all kinds of activities in a physical setting. Mediated communication tools (i.e. technology by which people can communicate with each other) play an important role in this. When CoPs are relying on a virtual place, they are called 'VCoPs'. A closer look on VCoPs is given, starting from section 2.1.3.

In order to fully understand the CoP concept, Allen, Ure and Evans (2003, p. 7) came up with the following definition: *"communities of practice are groups of individuals who participate in a collection of activities, share knowledge and expertise, and function as an interdependent network over an extended period of time with the shared goals of furthering their practice or doing their work better."*

CoPs can consist of different numbers of members. Some CoPs may have no more than ten members, while other CoPs can have over a hundred members. All CoPs have a core of community members who are indirectly pushing the community to interact as well. They are doing this with their passion and energy for the domain (i.e. the area of expertise), and are providing the community with intellectual and social leadership (Wenger & Snyder, 2000). However, not every community is a CoP. CoPs can be distinguished by three key elements. Wenger (1998) defines these three key elements as follows: joint enterprise; mutual engagement; and shared repertoire (see figure 2.2 on the next page).

CoPs are not just networks of people. They have an identity defined by a joint enterprise. A joint enterprise is not a stated goal, but defined by community members in their process of pursuing it. It is the joint enterprise what keeps the community together. It is also the joint enterprise by which the members of the CoP operate, and by which they set the context. A joint enterprise is not only about goals, it is also about mutual accountability, interpretations, and the like. The joint enterprise is under constant negotiation. Furthermore, the joint enterprise makes the difference clear between people within the community and people outside the community (Wenger, 1998).

Mutual engagement is the practice which exists in people who are engaged in actions that are central to the community, and negotiate it with others. Because CoPs exist by the virtue of its members, it is essential to focus the attention on anything that makes mutual engagement possible (Wenger, 1998). An important prerequisite of mutual engagement is that members are included in the things that matter in a CoP. Mutual engagement is not easily created, and is continuous under development (Wenger, 2000). An important part of mutual engagement is the community itself. Just having the same profession or living in the same area does not mean that people are participating in CoPs. Conversely, to participate in CoPs people have to interact and learn together (Wenger, 1998).

The third key element, which distinct a CoP from other communities, is shared repertoire. A shared repertoire can be seen a shared collection of resources (e.g. experiences; tools; and stories). A shared repertoire grows when members of the CoP are pursuing their joint enterprise. Time and sustained interaction is needed, in order for a shared repertoire to develop (Wenger, 1998).

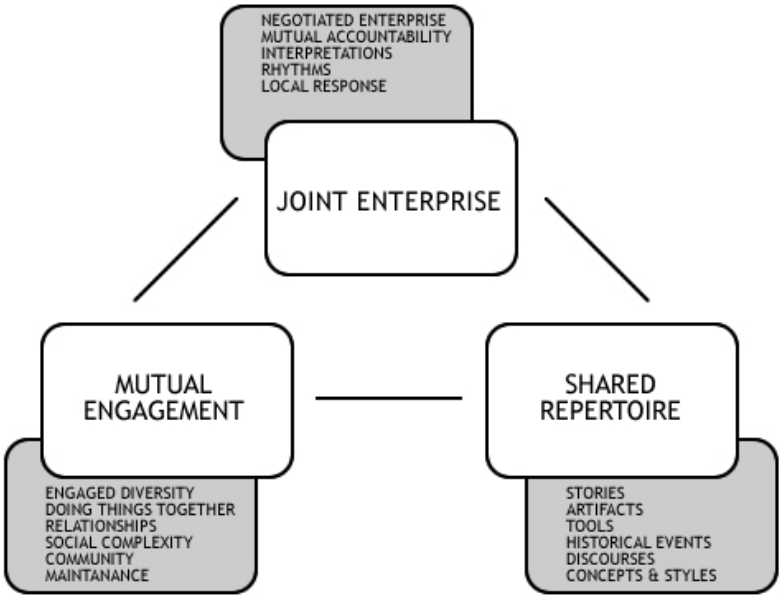

Figure 2.2: Dimensions of practice as the property of a community (Wenger, 1998)

CoPs can be informal learning environments where organizations or groups of individuals can provide training for their employees or community members, manage knowledge, and get work done. CoPs are becoming more and more acknowledged as possible (organizational) learning, and problem solving environments (Allen et al., 2003). The learning that emerges from these communities is collaborative. According to Johnson (2001), collaborative knowledge is greater than any individual knowledge. This kind of learning is what Wenger (1998) describes as 'situated learning'.

According to Wenger (1998), three dimensions of learning are taking place in a CoP. These three dimensions are related to the three key elements described earlier. The first one is 'understanding and tuning the enterprise'. In this dimension, community members have to struggle what the (goal of the) enterprise really holds, aligning their engagement with it, etcetera. The second dimension of learning is 'evolving forms of mutual engagement'. This means that members have to discover how they have to engage, define identities, develop mutual relationships, and the like. The last dimension is 'development of repertoire, styles, and discourses'. Members need to negotiate the meaning of various elements, produce or adopt tools, artefacts and representations, tell and retell stories, and so on (Wenger, 1998).

Individuals, as well as the whole community, but also organizations if applicable, profit from the usage of CoPs. CoPs are a vehicle to increase knowledge creation as well as expanding the extent, and accelerating the speed at which knowledge is exchanged (Saint-Onge & Wallace, 2003). Besides sharing knowledge (e.g. giving answers to problems) members who are part of a CoP get a lot more (e.g. support; insights; reassurance; and exposure to different system values and beliefs) (Preece, 2004).

Saint-Onge and Wallace (2003) have identified three types of CoPs. The first one is 'informal communities of practice'. These CoPs are loosely organized and are formed by people who need them to discuss issues for their work. The second type is 'supported communities of practice'. These CoPs are fully developed and have a more purposeful means to create knowledge in their domain. The third type is 'structured communities of practice'. These CoPs consist of highly motivated members and significantly contribute to the organization's performance. The characteristics are described in the table below (see table 2.1).

	Informal CoPs	Supported CoPs	Structured CoPs
Characteristics			
Purpose	Provide a discussion forum for people with affinity of interest or needs within their practice	Build knowledge and capability for a given business or competency area	Provide a cross-functional platform for members who have common objectives and goals
Membership	Self-joining, or peer invited	Self-joining, member invited, or manager suggested	Selection criteria outlined; invited by sponsors or members
Sponsorship	No organizational sponsor	One or more managers as sponsors	Business unit or senior management sponsorship
Mandate	Jointly defined by members	Jointly defined by members and sponsor(s)	Defined by sponsor(s) with endorsement of members
Evolution	Organic development	Purposeful development, co-determined by sponsor(s) and members	Organizationally determined development based on business objectives and alignment of purpose
Accountability	Not attached to formal accountability structure	Contribute to the realization of business objectives	Forms an inherent part of the accountability structure with specific objectives to achieve as outlined by the purpose

Organizational support	General endorsement of CoPs; provision of standard collaborative tools	Discretionary managerial support in terms of resources and participation; supplemented array of tools and facilitation support	Full-fledged organizational support on the same basis as organizational segments; budget allocation as part of business plans
Infrastructure	Most likely meets face-to-face for primary contact; has a means of communication for secondary contact	Uses collaborative tools; meets face-to-face on a regular basis	Uses sophisticated technology infra-structure to support collaboration and store knowledge objects generated in the community; highly enabled by technology
Visibility	Very natural, may not even be noticed	Visible to colleagues affected by the community's contribution to practice	Highly visible to the organization through targeted communication efforts that are stewarded by sponsors

Table 2.1: Community of practice characteristics (Saint-Onge & Wallace, 2003)

Concluding communities of practice

This section is summed up by giving an answer to the question stated in the beginning of this section: "*what are communities of practice, and what characterizes them?*" This answer is given by presenting a graphical overview (see figure 2.3). The answer is primarily based on the three dimensions of practice from Wenger (1998), and from the VCoP definition of Allen et al. (2003).

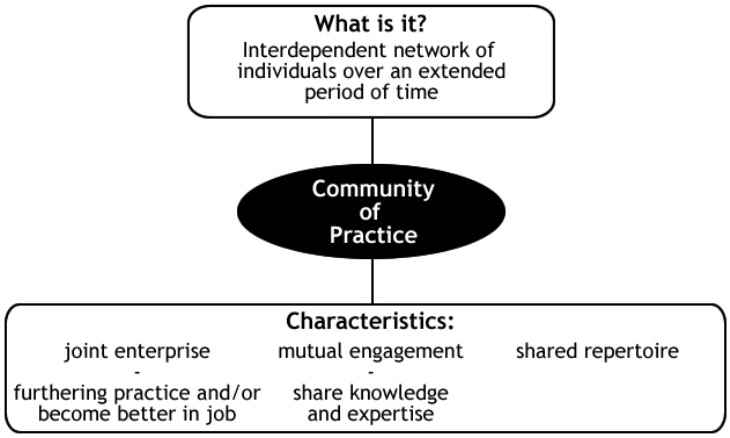

Figure 2.3: Communities of practice

2.1.2 Virtual communities

"Virtual communities emerged from a surprising intersection of humanity and technology. When the ubiquity of the world telecommunications network is combined with the information-structuring and storing capabilities of computers, a new communication medium becomes possible" (Rheingold, 1992). The term virtual community became world-known by the book of Howard Rheingold (1993), called 'The virtual community: Homesteading on the electronic frontier'. In this book he discusses his adventures on the WELL (i.e. Whole Earth 'Lectronic Link), one of the first virtual communities that have emerged.

In this section, the abstract term 'virtual community' is unravelled. This is done by addressing the question: "*what are virtual communities, and what characterizes them?*" Because virtual communities are a broad concept, it is defined and characterized first. This is followed by presenting the conclusions about virtual communities.

Defining virtual communities and its characteristics

Many definitions, which try to describe the virtual community concept, can be found in literature. Some definitions are closely related, while others differ significantly from each other. Rheingold (1992) gives the following definition of virtual communities: *"virtual communities are cultural aggregations that emerge when enough people bump into each other often enough in cyberspace. A virtual community as they exist today is a group of people who may or may not meet one another face-to-face, and who exchange words and ideas through the mediation of computer bulletin boards and networks."*

To date, this may seem as a somewhat broad and out-dated definition. Because the term 'virtual community' means different things to different people, there is not really an accepted definition for it yet (Preece, 2000). This is mainly due to the multidimensional nature of studies (e.g. sociological; technological; and e-commerce) that are conducted on virtual communities (Leimeister, et al., 2004). Other researchers would rather call a virtual community an online community (e.g. Menegon & D'Andrea, 2004). They stress that this kind of community has the same level of existence as a physical community. They furthermore claim that members of such communities do not question its reality. In this report, the term 'virtual community' is used, because it is the most used term in literature.

An improved definition of virtual communities is given by Porter (2004, p. 2). She defines virtual communities as follows: *"virtual communities are an aggregation of individuals or business partners who interact around a shared interest, where the interaction is at least partially supported and/or mediated by technology and guided by some protocols or norms."*

This definition rules all other definitions out for four reasons. First, it recognizes that virtual communities aggregate individuals or business partners. Second, this definition is more inclusive because it recognizes that communication can be either virtual or partly virtual. The third reason is that the definition is aware that not only computer-mediated tools have to be used for interaction. In stead, virtual communities can be mediated by any kind of technology. The fourth and final reason why this definition is better than the other definitions described in literature is that it includes the importance of protocols and norms, which is often neglected in other definitions (Porter, 2004).

In the definition of Porter (2004), it is claimed that virtual communities are formed around a shared interest by individuals or business partners. This means that virtual communities can have various appearances. In her study about virtual communities, Porter (2004) also tried to develop a typology of virtual communities (see figure 2.4). She defines virtual communities according to two levels. In the first level, the nature of establishment takes a central place. The relationship orientation (i.e. the relationship among members of the virtual community) is described as the second level.

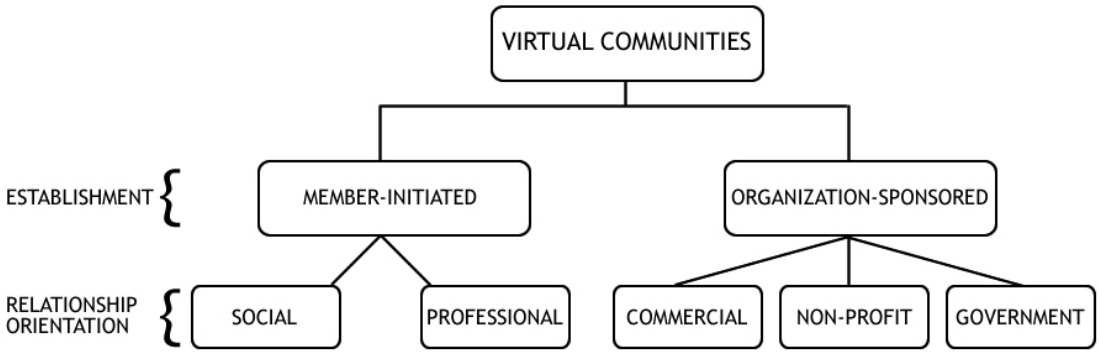

Figure 2.4: A typology of virtual communities (Porter, 2004)

The first level can be divided in two categories. The first category is 'member-initiated' virtual communities. Member-initiated virtual communities are founded and managed by members. The second category is 'organization-sponsored' virtual communities. Organization-sponsored virtual communities are sponsored by organizations. The nature of these organizations can be commercial, but also non-commercial (e.g. governments and non-profit organizations). These virtual communities have costumers, employees, and other stakeholders as their core members.

In the second level, Porter (2004) describes five relationship orientations. In a member-initiated virtual community, members can have either social or professional relationship with other members. Social relationships foster around leisure activities (e.g. hobbies and interests). Besides leisure activities, virtual communities are also fostered around networks of friends, or around special interest groups (e.g. diseases and pregnancy). Professional relationships are created by a shared professional interest. This type of virtual community can be characterized as a VCoP, which is described in the next section. The relationship orientations in an organizational-sponsored virtual community can be commercial, non-profit, or government-based. Members in this type of virtual community can have relations with individual members as well as with the sponsoring organization.

Although this typology is consistent with other virtual community typologies, and that it has made essential improvements over the other typologies (Porter, 2004), this typology is not all-embracing. Why can organizational-sponsored communities not have social or professional relationship orientations? Can member-initiated communities not have both social and professional relationships? These questions are examples of questions that would be worthwhile to investigate, in order to create a more comprehensive typology about virtual communities. Because this is not in the scope of this thesis, these questions will now be taken for granted.

Virtual communities differ in some respect from traditional communities. Members of virtual communities are successfully maintaining strong and supportive relations with other community members and can also have a large number of varied weak ties. Another characteristic that members in a virtual community hold is a great tendency to develop feelings of closeness. This is rather done on the basis of shared interest than on the basis of shared social characteristics (e.g. gender and socio-economic status). In other words, it can be said that members of a virtual community are homogenous in their attitudes and interests. This homogenous interest can translate itself to an empathic understanding and mutual support (Wellman & Gulia, 1997).

Jones (1997) makes a difference between virtual communities and virtual settlements. According to Jones (1997), a virtual settlement is the place where virtual communities can be formed. Before virtual settlements can be labelled a virtual community, four conditions need to be met. The first condition is a minimum level of interactivity. Interactivity is the condition where simultaneous and continuous communication occurs, which is encompassed by a social and binding force (Rafaeli & Sudweeks, 1997). The second condition is a variety of communicators. This condition is related to the first one. There can be no interactivity with only one communicator. A minimum of sustained membership is the third condition. The fourth and final condition that needs to be met is that there should be a virtual place where a major amount of interactive group computer-mediated communication takes place (Jones, 1997).

Preece and Maloney-Krichmar (2003) sum up five important characteristics of virtual communities. These five characteristics are: members have a shared goal, interest, need or activity; members engage in repeated, active participation; members have access to shared resources; exchange of information, support, and services; and members have a shared context of social conventions, language, and protocols.

Other less important characteristics, which could have an impact on virtual interactions, are: the reputation of the members; the different roles of the members; the criteria for joining the community; the events that are organized; the shared physical environment; the voluntary nature of memberships; membership boundaries; and the identity of the group (Preece & Maloney-Krichmar, 2003).

Porter (2004) uses five attributes to characterize virtual communities. She does so by assigning the five 'P's' from management (i.e. purpose; place; platform; population; and profit) to virtual communities. These characteristics are more global in nature than the characteristics which are described by Jones (1997), Wellman and Gulia (1997), and Preece and Maloney-Krichmar (2003), but are worthwhile to mention.

Purpose (content of interaction). Virtual communities are defined by an infinite number of shared interests. These interests are the main purpose communities exist (e.g. Blanchard, 2004; Porter, 2004). Community members can deepen their expertise by closely working with other members who are active in the same field (e.g. technicians learn more about technique from other technicians than from sales people), but members can also learn from other members that are unlike themselves. Members from different backgrounds can discover some common ground, which may ignite useful discussions. Therefore, it is important to seek a good balance between separating and combining communities (Carotenuto, Etienne, Fontaine, Friedman, Muller, Newberg, Simpson, Slusher & Stevenson, 1999).

Place (extent of technology mediation of interaction). Interactions in virtual communities can be completely or partial virtual. Traditional communities are bounded by geographical borders.

Interactions in such communities create sense of belongingness, shared values, and mutual understandings. Thus, the concept of a community is both structural and socio-psychological (Porter, 2004). When interactions are completely virtual, this may be harder to achieve. In a virtual community there is in most cases no physical place where community members can meet. Predominantly, members form mental models of the virtual community. In that way they create a virtual place (Blanchard, 2004). The advantage of having a virtual meeting place is that people do not have to travel. This reduces costs and saves time significantly.

The location of a virtual community is very important, because it provides the virtual place where members meet (Ridings, Gefen & Arinze, 2002). Virtual places are often seen as virtual spaces. Harrison and Dourish (1996) are stressing that a virtual space is to a virtual place as a house is to a home that has physical boundaries. Mitra and Schwartz (2001) suggest that a member's sense of presence can be influenced by technological properties. They also put forward that the use of metaphors to the physical world enhances the sense of location in the virtual environment. All technological environments are created by a computer and can only be understood because of the experience one has with the real world (Stone, Jarrett, Woodroffe & Minocha, 2005).

Platform (design of interaction). Synchronicity is an important concept considering the interactions in a virtual community. Synchronicity is the degree to which a medium enables real-time interaction. This term is often used to describe synchronous interaction (e.g. multi-user dungeons (further referred to as MUDs) and chat rooms) and asynchronous interaction (e.g. forums and newsgroups). Virtual places can also provide synchronous and asynchronous communication together (Porter, 2004).

The major differences between face-to-face communication and communicating in a virtual way are the concepts of time and space (Blanchard, 2004). These concepts are related to physical communities, and are weakened when applied to virtual communities. Technologies, especially the internet, allow virtual communities to exist (Johnson, 2001).

Virtual communities are accessible twenty-four hours a day, seven days a week. Community members can participate in their virtual community anywhere in the world, as long as they have a computer and an internet connection. This means that the virtual community is never closed, and can have an ongoing life-span (Blanchard, 2004). This has a positive effect on finding good solutions to problems in a fast way.

Community members can also participate whenever they want. However, one note has to be made. This can only be done with asynchronous communication tools. When synchronous tools are used, all members need to be available at the same time. This can sometimes be a problem, especially when people are located in different time-zones. A-synchronous communication on the other hand does not require this. Community members determine for themselves when they wish to contribute. A downside of a-synchronous communication is that interactions can take much longer (e.g. days; weeks; or even months) (Preece & Maloney-Krichmar, 2003). Moreover, the separation of time and space can create another dilemma. Wenger, White, Smith and Rowe (2005) ask themselves how togetherness can be experienced when physical meetings are not realized. Technology plays a big role in this. Technology should provide the new structures for community members to create togetherness.

Member's perception of social presence, co-presence, and sense of place can be enhanced when virtual places are highly interactive (Blanchard, 2004). Rafaeli and Sudweeks (1997) suggest that interactivity can facilitate the construction of social reality. Nonetheless, they also make a critical note. When a virtual place is highly interactive of nature, it does not mean that it will be used in an interactive manner.

Preece (2001) makes a clear statement that not only sociability is important in a virtual community, but also usability. Usability is the extent to which a product can be used by specific types of users to achieve specific types of goals in a specified context of use with as much effectiveness, efficiency, and satisfaction as possible (Stone et al., 2005). The ease and intuitively of use of the virtual community should be given great care. The concepts sociability and usability are closely related. However, sociability is concerned with how community members interact with each other, while usability is concerned with how community members interact with technology (Preece, 2001).

Population interaction structure (pattern of interaction). Porter (2004) defines three interaction structures in virtual places. The first one is computer-supported social networks (further referred to as CSSNs). Examples of CSSNs are: email; bulletin board systems; MUDs; newsgroups; and Internet Relay Chat (Wellman & Gulia, 1997). Virtual communities are a form of CSSNs that support strong, weak, and stressful social ties among community members (Garton, Haythornthwaite & Wellman, 1997). According to them, strong ties emerge when there is regular and supportive contact between socially connected members of a virtual community. Strong ties are like the contact one has with close friends or colleagues. Strong ties include the combination of intimacy, self-disclosure, frequent contact, and exchanging services. Despite the fact that weakly tied members are socially and/or physically disconnected, they can also demonstrate supportive and reciprocal behaviour (i.e. sharing information and resources). They often have access to different kinds of resources, which might provide opportunities to help each other. A stressful tie emerges when communication among members becomes anti-social (e.g. flaming and spamming).

The second interaction structure is virtual communities as small-groups or networks. Van Dijk (2006, p. 24) describes networks as *"a collection of links between elements of a unit."* A single link of two elements forms a relation(ship). Thus, networks are a mode of organization of complex systems in nature and society. When comparing the interaction patterns in small groups and large networks, some differences arise. In small groups there are fixed and limited memberships, whereas in large networks there are variable and a large number of memberships. Small groups are communicating in a highly interactive way, in sessions of limited duration, and have well defined activities. Large networks on the other hand, tend to have less active communication sessions (Porter, 2004).

The third and final interaction structure is virtual communities as virtual publics. Virtual publics are mediated spaces. Virtual spaces can have different properties. They can be CSSNs, they can be supported by different technologies, they can have different purposes, and they can be owned by an organization. Virtual spaces are mostly clear and open environments, and allow groups of individuals to attend and contribute to a similar set of mediated (interpersonal) interaction (Porter, 2004).

Profit model (return on interaction). This attribute focuses on the creation of tangible economic value. Besides organization-sponsored virtual communities, member-initiated virtual communities can also create economic value (e.g. by advertising) (Porter, 2004).

Concluding virtual communities

This section is summed up by giving an answer to the question stated in the beginning of this section: what are virtual communities, and what characterizes them? This answer is given by presenting a graphical overview (see figure 2.5). The answer is primarily based on the results of the studies of Jones (1997), Preece and Maloney-Krichmar (2003), and Porter (2004).

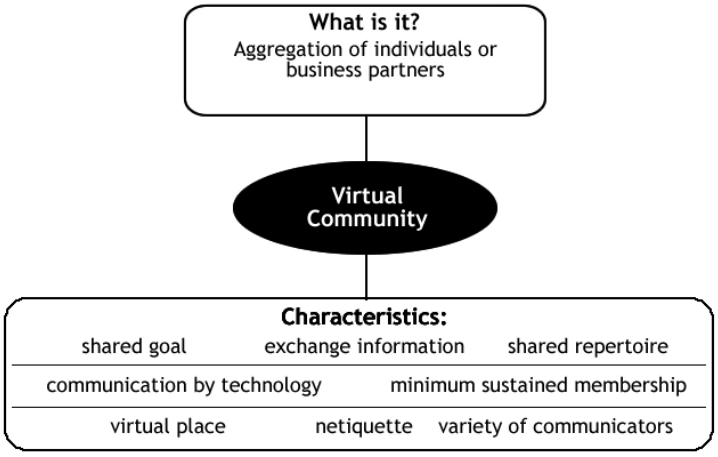

Figure 2.5: Virtual communities

2.1.3 Virtual communities of practice

In this section, the VCoP concept is highlighted. This is done by finding an answer to the following question: "*what are virtual communities of practice, and what characterizes them?*" First, a definition of the VCoP concept and its characteristics are presented. This section ends by wrapping up the conclusions.

Defining virtual communities of practice and its characteristics

VCoPs are a merging of CoPs and virtual communities. VCoPs arise from virtual communities by the means of how members are using these virtual communities (Johnson, 2001). This means that when a virtual community displays the characteristics of a CoP, there can be spoken of a VCoP. However, this does not mean that CoPs have to be either virtual or physical. A combination of both is also possible (Porter, 2004).

A VCoP shows some overlap considering CoPs. Both VCoPs and CoPs are following the same agenda, their members need to engage with each other, and there is a shared repertoire. The two major differences are that members of CoP are located near each other, while members of a VCoP are dispersed on a national or international level. This means that communication takes place differently as well. In a CoP, communication often takes place in a physical setting, while communication in a VCoP is primarily done by using mediated communication tools. This allows community members, according to Schraefel, Ho, Chignell and Milton (2000), to work separately while still experiencing a mutual sense of presence.

Lai, Pratt, Anderson and Stigter (2006) describe some other differences between CoPs and VCoPs. They state that VCoPs are usually designed top-down, whereas CoPs emerge from existing groups. VCoPs are usually open communities, while CoPs are most of the time closed. Leaders emerge in a CoP, but in a VCoP they are often recruited. A VCoP needs much time to fully develop, whereas CoPs are developing in a fast way. The last point of difference is technological support. This is obviously not interesting for CoPs, but essential for VCoPs. While the authors tried to make a difference between CoPs and VCoPs, one thing needs to be taken in mind. How far can one actually go in making a difference between CoPs and VCoPs? CoPs are often enhanced with supportive technology, and members of a VCoP often have physical meetings.

The purpose of VCoPs is getting more substance now the world is becoming more networked (van Dijk, 2006). It is for example advantageous for researchers to be able to collaborate at a distance with fellow researchers. This kind of collaboration can be made possible when using mediated (collaborative) communication tools (Schraefel et al., 2000). They posit that successful collaboration is met when members of a VCoP share information and communicate with each other effectively.

Communication and collaboration are the basis on which VCoPs get started. Though these two terms are narrowly related, they differ in some respect. Members in a VCoP communicate what they think and what to do. Then they collaborate (e.g. solving created problems and making discoveries within the community's expertise). Collaboration creates a shared meaning about a process, product, or an event. The virtual place of the VCoP should make it possible to support all types of collaboration at any time or place (Schraefel et al., 2000).

In order to embrace the term 'virtual community of practice' a definition is given. Allen et al. (2003, p. 7) define VCoPs as follows: *"a virtual community of practice is a physically distributed group of individuals who participate in activities, share knowledge and expertise, and function as an interdependent network over an extended period of time, using various technological means to communicate with one another, with the shared goals of furthering their practice or doing their work better."* Although, this is a good definition of VCoPs, it misses the part of protocols and norms as described in Porter's (2004) definition of virtual communities.

VCoPs are often used as knowledge management tools. VCoPs and knowledge management go hand in hand. Many companies have used the internet to connect professionals around the world to share documents and to work together. But many are finding out that sharing ideas and insights are of more value in a knowledge management structure (McDermott, 2000). VCoPs are now recognized as effective knowledge sharing environments (Lueg, 2000). Ardichvili, Page and Wentling (2003) have noticed that VCoPs are extensively used in many multinational organizations as a knowledge management tool.

VCoPs provide knowledge management from two perspectives. First, codified knowledge can be accessed through online repositories of files and information, which are often accompanied by search engines. This perspective is called 'codification'. The second perspective, which is called 'personalization', suggests that knowledge is managed through people instead of through documents (e.g. brainstorm sessions) (Allen et al., 2003).

These two perspectives can be translated in two types of knowledge, namely: explicit knowledge (i.e. hard knowledge); and implicit knowledge (i.e. soft knowledge). Explicit knowledge includes: documents (e.g. journals; books; and conference papers); recorded discussions; defined workflows; and the like. Because most communication and information exchange is done electronically in a VCoP, it can be easily captured, stored, and archived for reference. Implicit knowledge can be found inside the heads of the community members (e.g. experiences). Community members can share this knowledge with other members by interacting with them. In other words, members of VCoPs can learn from, discuss about, and contribute to the community's explicit knowledge, and they can share their implicit knowledge (Bieber, Engelbart, Furuta, Hiltz, Noll, Preece, Stohr, Turoff, & van de Walle, 2002; Hildreth et al., 2000; Preece, 2004).

Furthermore, in order to help manage knowledge in a VCoP, it also supports the members of the community in their learning process. Community members are willing to participate in a VCoP if they are supported in their learning process, and if they can perform better in their jobs. This is realized by the interaction that takes place among community members. By interacting with community members, the retention of knowledge is reinforced (Bieber et al., 2002; Allen et al., 2003).

Although it may seem that creating and sharing knowledge is only done virtually in a VCoP, it is not entirely the case. Most actions in knowledge creation happen in the real world. Moreover, most knowledge that is generated is only applicable to the real world (Lueg, 2000).

Saint-Onge and Wallace (2003) have developed a knowledge structure, which is highlighted in figure 2.6. The collective knowledge of an organization is placed at the disposal of every individual in real-time as a fundamental part of everyone's work. Individuals can capture all knowledge through knowledge access, and knowledge exchange. In this context, it means that a VCoP is based on three mechanisms. These mechanisms are: access to existing knowledge (e.g. a knowledge base); knowledge exchange by sharing experiences; and creating new knowledge by collaborating (e.g. sharing ideas) with community members.

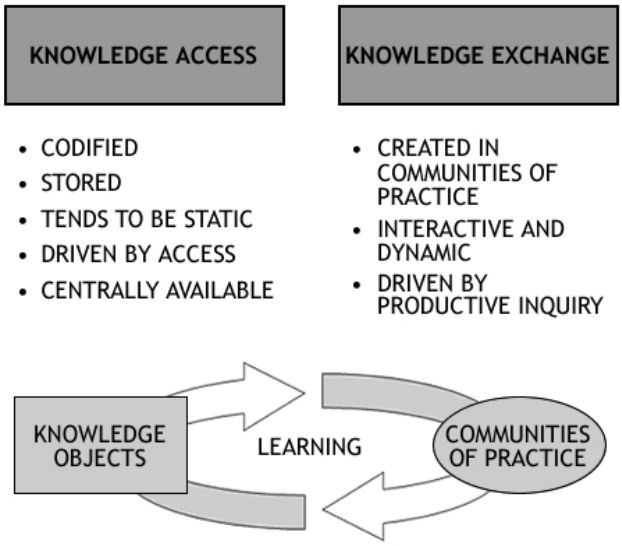

Figure 2.6: Knowledge architecture (Saint-Onge & Wallace, 2003)

Although people may think that their knowledge belongs to the community (Ardichvili et al., 2003), Wenger (1998) describes that people themselves should feel that they belong to the community. He considers three modes of belonging (see figure 2.7 on the next page). Although this model could already be brought up in the section about CoPs, it is introduced here, because in this section knowledge plays an important role.

The first mode is 'engagement' (i.e. active involvement in mutual processes of negotiation and meaning). Through engagement people learn how to behave and how surroundings are responding to their behaviour. However, engagement is limited by physical and psychological boundaries. In this mode, the CoP is basically formed.

The second mode is 'imagination' (i.e. development of a mental model). In this mode, people should have the capability to reinvent themselves, their enterprises, their practice, and their community. It is required to have an ability to explore, to take risks, to reflect, and to create uncommon connections.

The last mode is 'alignment' (i.e. coordinating activities and energy, in order to fit within the structures of the community and its domain). This mode requires to direct energies to a common purpose by coordinating perspectives and actions. Alignment improves the effect that actions may have.

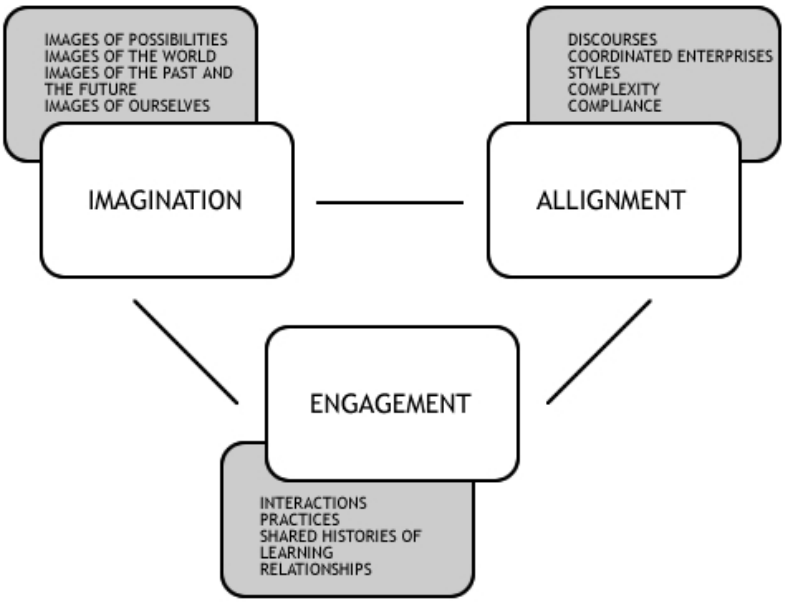

Figure 2.7: Modes of belonging (Wenger, 1998)

VCoPs are organizing themselves, which means that they set their own agenda. Membership in a VCoP is self-selected. People themselves determine (when) to join or not to join a VCoP, which means that participation is voluntary of nature. What makes VCoPs successful is its ability to generate excitement, relevance, and value to attract and engage members (Wenger et al., 2002b). But how are VCoPs set up, and what makes VCoP members motivated to really participate in a VCoP? These questions are addressed in the following paragraphs.

Concluding virtual communities of practice

This section is summed up by giving an answer to the question stated in the beginning of this section: "*what are virtual communities of practice, and what characterizes them?*" This answer is given by presenting a graphical overview (see figure 2.8). The answer is primarily based on the results of the studies of Wenger (1998) and Allen et al. (2003).

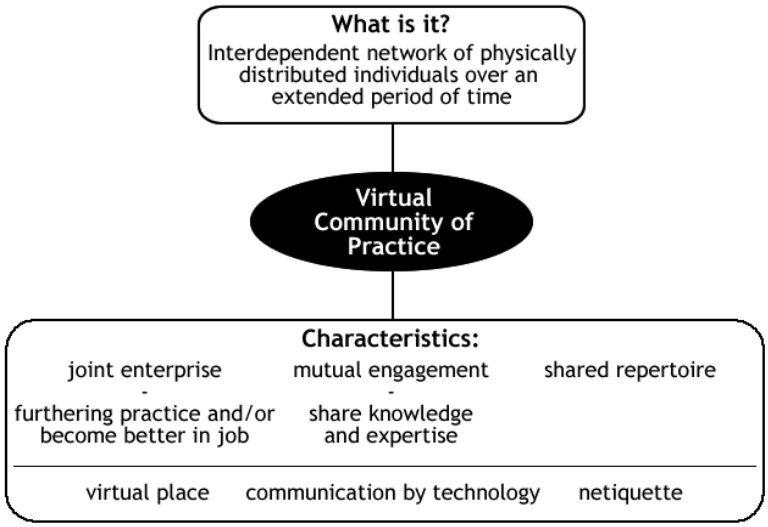

Figure 2.8: Virtual communities of practice

2.2 How do virtual communities of practice develop?

This paragraph explains how VCoPs are built up and how they evolve. This paragraph is necessary, in order to answer sub question three *(i.e. which practical concepts can be obtained from current literature that will explain the steps that need to be conducted to set up a virtual community of practice?)*. The questions that could be extracted from this sub question are addressed in the individual sections.

The paragraph starts with explaining the pre-conditions that need to be met before a VCoP can be set up. The actual steps that are needed to set up a VCoP are addressed thereafter. The conclusive section of this paragraph treats the phases a VCoP can be in. The results from this paragraph are, in a large extend, used to create the VCoP process model, which is highlighted in paragraph 5.1.

2.2.1 Pre-conditions to set up a VCoP

This section deals with the following question: "*which pre-conditions, which can be obtained from current literature, are necessary before setting up a VCoP?*"

Just start building a VCoP and expecting it to be successful is an unrealistic way of thinking. There are some factors that play an important part setting up a VCoP, which are explained in the next paragraph. However, there are some pre-conditions that need to be met first before setting up a VCoP. An important distinction between factors and pre-conditions is that factors can be influenced prior to the development of a VCoP, and pre-conditions can not.

Wenger et al. (2002b) address the significance of pre-conditions. They have developed seven design principles that should be followed before the VCoP has been created. Moreover, they stress that these seven design principles are important during the life-span of the VCoP as well. These seven design principles are articulated in the box below.

1. Design for evolution
When the focus of the community members is changing, so should the focus of the VCoP. This is also attributed by Allen et al. (2003). However, Stuckey and Smith (2004) make a critical note here. They state that there should be a balance between stability and change. This has two reasons. When there is too much change, the sense of identity is in danger. On the other hand, when there is too little change, the relevance and power of the VCoP can decrease drastically.

2. Open a dialogue between inside and outside perspectives
Designing a successful VCoP requires a deep understanding of the community issues. These issues can only be obtained from an insider of the community. Nonetheless, outsiders can often help the inside members see what the opportunities of a VCoP are, and what a VCoP could mean to them.

3. Invite different levels of participation
Different people have different skills and knowledge. Therefore it is important to invite different people to participate in the VCoP.

4. Develop both public and private community spaces
People who are not part of the community can experience the community, and can be motivated to join in.

5. Focus on value
Because participation in VCoPs is often voluntary, value is the key. However, value has to form over time, and is not always clear in the beginning.

6. Combine familiarity and excitement.
Successful VCoPs can create the atmosphere of a familiar place, but they have to facilitate appealing and diverse events as well, in order to keep new ideas and new members cycling into the community.

7. Create a rhythm for the community.
The rhythm that exists within the VCoP is the strongest indicator that the community is alive. Wenger et al. (2002b) define rhythm as the heartbeat of the VCoP combined with the interactions (e.g. meetings and video conferences) that are taking place over a certain period of time. This rhythm needs to be balanced. If the rhythm is too fast people stop contributing because they feel overwhelmed, and if the rhythm is too slow, the community is becoming tired out.

Saint-Onge and Wallace (2003) are also stressing the importance of pre-conditions. In their extensive book about VCoPs they address seven pre-conditions that should be met before creating a VCoP. These seven pre-conditions are: there should be a sense of shared purpose and ownership; there should be a shared mind-set; there needs to be a readiness to learn from each other; a trustworthy climate should be emitted; there should be a strong technological foundation; the context should be supportive; and the expectations (i.e. return on investment) should be corresponded realistically.

According to Ardichvili et al. (2003) there are three requirements for successful participation in a VCoP. First of all, community members of a VCoP need to be willing to share knowledge. Furthermore, community members need to use the VCoP as a source of knowledge, and need to be comfortable to participate (and communicate) in the VCoP.

Terra (2003) conducted case studies about VCoPs in eleven different organizations. Despite the differences in the cases, some commonalities were discovered. These commonalities were polished into twelve VCoP guidelines, which are described in the box below. Although some of these guidelines are not necessarily pre-conditions, they are presented, in order to maintain inclusive.

1. Establish a sense of identity for the community
An identity can be created by establishing clear goals, objectives, and purposes for the community. An identity can also be created by the development of a sense of history of the community. Hildreth et al. (2000) utter that, in order to establish an identity in faster ways, physical meetings are needed. Walsh and Maloney (2007) also depict the importance of such meetings. Physical meetings play a big role in maintaining the integrity of the community. The norms of the community can be easily established, and commitment can be reassured. Physical meetings can furthermore generate shared experiences, which can serve as benchmarks for later mediated communication.

2. Develop a strong communications plan
This is also attributed by Allen et al. (2003). People have to be motivated and triggered by internal communication to use the VCoP (e.g. by posters; newsletters; and training sessions).

3. Develop rules of engagement for the community
The 'leaders' of the community should develop protocols and norms (i.e. a netiquette) for the community. By having a netiquette, community members know how (e.g. style and vocabulary) and when (e.g. routines) to contribute. Preece (2004) denotes that norms help members to socially bind together, and help create a sense of community amongst community members. Without a netiquette the VCoP can not function. She makes clear that rules within a netiquette are learned through experience. In a successful VCoP, these norms become so strong that the VCoP becomes self-governing (i.e. members start thinking like a community instead of individual; member's individual goals are replaced with community goals; and predefined policies are replaced by norms).

4. Use common language and keep the layout simple
When using common language, the members of the VCoP understand each other, and fruitful collaboration can take place. It is also important to keep the layout of the VCoP simple. This makes the VCoP better and easier usable.

5. Lead by example, and make sure that a critical mass is developed rapidly
Community leaders should participate in frequent activities. In that way members become motivated about the VCoP and are willing to contribute themselves. VCoPs need a critical mass to remain active and hold attention of community members (Terra, 2003). Critical mass is often described as the number of community members, or activity, necessary for a community to function (Bieber et al., 2002).

6. Quality of content is more important than quantity
VCoPs are focussing on knowledge. If community members do not trust the information within the VCoP, they will quickly stop using it. Feedback mechanisms could be used to facilitate in quality control of the submitted information.

7. New members need special attention
It is very important to greet, coach, and motivate new community members to contribute. This can be done by alerting them when events are on the agenda, or reminding them of the benefits of the VCoP, and the like. It is very common that community members log in a few times and never show up again.

8. Allow for both centralized and decentralized community creation
This means that besides the core-group, community members should have the opportunity to create sub communities on their own.

9. Members need to develop an online identity
In order to foster human connections, identity is the key. Accurate user profiles can create trust among the community members of a VCoP.

10. Recognize different levels of participation, and develop reputation system
When members receive credit for their contributions they feel happier, and are more motivated to contribute again. Moreover, it gives community members an indication how much they can trust another.

11. Monitor activity and satisfaction level
It is very useful to conduct offline and online surveys from time to time. By doing this, problems can be discovered and member's satisfaction with the VCoP can be measured. This type of method is also referred to as 'tracking'.

12. Promote special online and offline events and celebrate success
Most VCoPs are dependent on community members who contribute on a voluntary basis. They can not be forced to contribute. Therefore, events should be promoted and successes should be celebrated, which can trigger the existing members, and can act as advertisements for people who have not yet joined the VCoP.

Another important pre-condition, which is seldom mentioned in literature, is to take general design guidelines in account (see Appendix I). Design guidelines make the work of both the developer and the actual user of the VCoP easier. The developer understands what to take into account to make the VCoP easy accessible and easy to use. The user on the other hand benefits from this. When the VCoP is easy accessible and easy to use, it takes the user less effort to work with and get used to the VCoP.

2.2.2 The steps to create a successful VCoP

A VCoP can not be built in one day. It takes time for a VCoP to be developed and to develop. How it will develop can be read in the next section. In this section, the steps which need to be followed to create a VCoP are described. This section treats the question: "*which steps, which can be obtained from current literature, are needed to set up a virtual community of practice?*"

Before addressing the steps that are needed, in order to set up a VCoP, it is fruitful to first understand the architecture of a VCoP. Saint-Onge and Wallace (2003) have done a good job in trying to create a meaningful architecture for VCoPs (see figure 2.9).

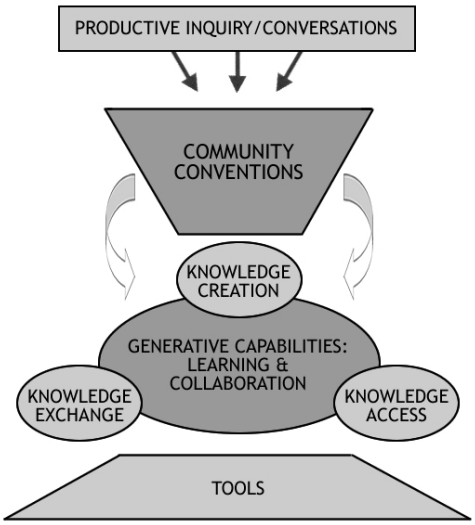

Figure 2.9: The architecture of a virtual community of practice (Saint-Onge & Wallace, 2003)

The architecture presented in the figure above can be read as follows: a community member generates a question in the 'productive inquiry' (i.e. the component that drives capability generation) which leads to a conversation. This conversation is filtered through 'community conventions' (i.e. the protocols and norms). The knowledge objects are accessed and exchanged, and sometimes, the conversation results in the creation of a knowledge object. This is done in the 'generative capabilities' component of the architecture. The overall process is supported by the 'tools and technology infrastructure' of the VCoP (Saint-Onge and Wallace, 2003).

Now it is time to unfold the steps that are needed, in order to create a (successful) VCoP. First, the steps of Allen et al. (2003) are presented, which is followed by the steps of Saint-Onge and Wallace (2003). The steps how to create virtual communities, described by Preece (2000), are addressed as well.

Following the remarks from Allen et al. (2003), nine steps need to be taken, in order to create a VCoP. These steps are described in underlying box.

1. Identify the purpose and need of the VCoP
The purpose and need should be aligned with the goals and strategy of the business or organization.

2. Decide how to measure success
The success of a VCoP should be assessed on the defined purpose and need from step one. Actual measurement is done in step nine.

3. Identify the tools and infrastructure that is going to be used
Technology is essential for a VCoP to exist, so this is a crucial step. The tools should be selected on base of the objectives and purposes that are essential to be met by the community. Thereby, it is important to not assess the tools themselves, but the capabilities they provide. The allowance for evolution is also very important when selecting technology.

4. Develop a business plan
In a business plan, steps one to three are carefully described. The purpose of a business plan is to show which actions need to be performed, and how the VCoP is going to be implemented. Allen et al. (2003) also stress that all the other steps, which are described hereafter, must be documented. Moreover, they recommend that the business plan should consist at least of a statement of purpose or need, evaluation criteria, resource requirements, budget requirements, business case, benefits of implementing a VCoP, and community stakeholders.

5. Get organizational support
This can be done by presenting the organization a clear business plan. It is also recommended to let management or other appropriate stakeholders review the business plan and let them provide feedback. This is important for organizations who want to implement a VCoP.

6. Establish structure
In this step, the virtual place, which is used for interaction, is set up. The participants in the study of Allen et al. (2003) commented that it is important to keep the ease-of-use, the user-friendliness, and the regular work processes of the members in mind. It is also highly recommended to look at other VCoPs to see what they are doing, and how they are doing it.

7. Establish membership
The seventh step consists out of two parts. The first part is to establish membership criteria (e.g. restricted versus open memberships). Membership criteria should be developed around the purpose and need of the VCoP. The second part in this step is identifying, attracting, and educating members. This can be done in lots of ways (e.g. word of mouth; newsletters; and by advertising on the internet). When a VCoP is going to be created for a community that already exists, the identification of the members is a lot easier. Educating community members is also a very important process. Community members need to understand the purpose of the VCoP and the role that they are playing in it. They also need to understand how and when to contribute and participate. Therefore it is important to set up a netiquette.

8. Conduct a pilot test
This is also an important step. This step is mostly conducted in parallel with steps six and seven. In this step, errors can be detected and solved, and members can provide feedback about what works and what does not. The community can also be easily observed, and the needs of the community can be identified. If the needs seem to be different from what was expected, the VCoP can be modified. This is easier and cheaper in the pilot phase of the VCoP, than when the VCoP is fully developed.

9. Evaluate and revise the VCoP
Evaluation and revision of the VCoP is critical for a VCoP to become successful. The methods to monitor the success of the VCoP, which are described in step two, need to be conducted on a regular basis. It is important to understand if the (pre-defined) goals of the VCoP are met. The focus of a VCoP can evolve over time (Wenger, 1998), which means that the needs and purposes of the VCoP also may change (Allen et al., 2003). This indicates that continuous evaluation of purpose and goal is essential. Allen et al. (2003) conclude their nine steps by giving one piece of advice. It is for the better of the VCoP to start off small and to only integrate basic functionality. New and advanced technology need only to be built in when it is needed.

Unlike the steps of Allen et al. (2003) and Preece (2000), which are described next, Saint-Onge and Wallace (2003) demonstrate the steps to build a VCoP purely on the basis of their experience. Although it is not theoretically tested, practical insights might be very useful. They recognize that their steps should not be looked at as a cookbook, but that it should highlight key points for consideration when developing a VCoP. They also mention that while it seems that the steps could be run though in a chronological order, it is anything but that. The steps needed for development of a VCoP usually adopt an iterative approach.

Saint-Onge and Wallace (2003) divide the development process of a VCoP in two phases. The first phase is the community design and launch phase. In this phase the preparations of the VCoP launch take a central place. The second phase is the community implementation and growth phase. In this phase the VCoP matures through an ongoing sequence of development, evaluation, and growth. This is the phase in which the community should take responsibility for itself. When these two phases are combined, eight steps can be differentiated. The first three steps fall under phase one, and the other five under phase two. The steps that are defined by Saint-Onge and Wallace (2003) are described in the underlying box.

1. Define the community project
In this step, the context is set (e.g. purpose; relevance; environmental factors; culture; expectations; and explanation of the VCoP concept), the project approach is designed (e.g. guiding of project development and evaluation of the process; defining roles and responsibilities; choosing the right tools; and developing a project strategy), resource requirements are identified, and deliverables are defined (e.g. project plan; working documents; and presentations).

2. Establish the community components
In this step, the project tasks are identified and accomplished. Also the practical issues (i.e. outlining governance and community structures; establishing membership; obtaining technology infrastructure; addressing technical issues and user support; preparing content; learning to use the community technology infrastructure, facilitation roles, and responsibilities; and establishing a communications plan) are realized.

3. Launch the VCoP
The final step of phase one is to launch the VCoP. This means that the VCoP is online, and accessible to all its members. In this step, ensuring site and member readiness is a prerequisite. In case of a corporate VCoP, permission of management may be needed. This step is the start of the community building process.

4. Establish the community
In this step, a sense of community is cultivated (e.g. member profiles; assessing needs and identifying styles; introducing the facilitator; encouraging participation; and increasing community literacy). Increasing computer literacy can be achieved best by proper introductions of the functionality of the different tools, rather than putting a manual online and letting members wrestle with it themselves.

5. Insert a checkpoint (i.e. assessing progress and value)
Saint-Onge and Wallace (2003) insert a checkpoint as step five. The progress of the VCoP, and the value to its members are informally evaluated (e.g. collecting informal comments; analyzing statistics; requesting feedback on perceptions (i.e. consulting); and providing feedback to the software vendor).

6. Grow the community
By finding strategies for community building, knowledge creation and sharing, and knowledge navigation approaches, the value of the community becomes bigger, and as a result, its number of members will expand. In this step it is important to construct community activities, familiarize members with software functionality, focus communication on community's value, strengthen the network of expertise, and harvest knowledge.

7. Evaluate the purpose and direction of the VCoP
The needs of the community are identified in this step. This is done by a formal review of the community's progress and its value to its members. Important actions in this step are designing a data collection tool, gathering and analyzing data, making recommendations, stating findings, and communicating the results.

8. Expand the community
Expanding the community can be defined as the final step in the development process of Saint-Onge and Wallace (2003). In this step, the community should be lifted to a higher level. The initial scope and membership of the VCoP should be expanded, the value should be increased, and the VCoP should become part of a larger community network. The members and other stakeholders of the community should be involved in these processes. As a final thought about developing a VCoP, the authors state that it is very important to conduct a pilot study in order to minimize potential risks.

Preece (2000) has written a book about how virtual communities can be set up. Her book is not specifically about VCoPs, but the dimensions usability and sociability, which are useful in any kind of virtual community, are carefully presented. For that reason, also the steps of Preece (2000) are included in this section. Preece (2000) defines five steps to cultivate a virtual community. These steps are presented in the box below.

1. Identify the needs of the community and the tasks that will be needed to carry out
The main goal of this step is to identify the users (e.g. demographic information and internet experience).

2. Select the proper technology and planning for sociability
It is very important that technology is chosen with the right functionality and usability.

3. Designing, implementing, and testing prototypes
This step results in an advice about how to design the virtual community.

4. Refine and tune sociability and usability
The third and fourth steps are narrowly related with each other. Both steps need an iterative approach in order to create an optimal virtual community.

5. Welcome and nurture the community
The virtual community has to be made well-known by sending out e-mails, advertising, and by leaving a link behind on other web sites. It is preferred to observe the community narrowly (e.g. the first six months), and try to solve problems that may come across.

2.2.3 Evolution phases of a VCoP

This section deals with the following question: "*how do virtual communities of practice evolve over time?*"

In order to get a more complete picture about VCoPs, it is fruitful to understand what kind of phases a VCoP can be in. Wenger, McDermott and Snyder (2002a) have developed the VCoP lifecycle. Cited by Saint-Onge and Wallace (2003), Wenger et al. (2002a) identified five stages in the VCoP lifecycle (see figure 2.10). The order of the stages does not have to be the same for all VCoPs, but in general, the lifecycle presented in the box on the next page can be observed.

Phase 1: Potential (i.e. the discovery phase)
People with similar issues and needs find each other and identify the potential for forming a community.

Phase 2: Coalescing (i.e. the grow phase)
The community is formed as activities develop to meet the needs of the community members.

Phase 3: Maturing (i.e. the ripe phase)
Community members begin to plan directions, set standards, and engage in joint activities. The value of the community has been established. It begins to clarify its focus, role, and boundaries. The community is the most active in this phase.

Phase 4: Stewardship (i.e. the maintaining phase)
The community begins to plateau. Although energy and activity continue, members who were once enthusiastic may take a sideline position. The main issue for the community is to sustain its momentum, and to recognize the natural changes in practice, membership, and relationship (to the organization). However, the community itself still has some power.

Phase 5: Transformation (i.e. the changing phase)
Community members leave the community when it is no longer useful or pertinent to them. New people join and the focus changes, returning the community to a new growth stage or moving towards closure. The experiences are maintained though.

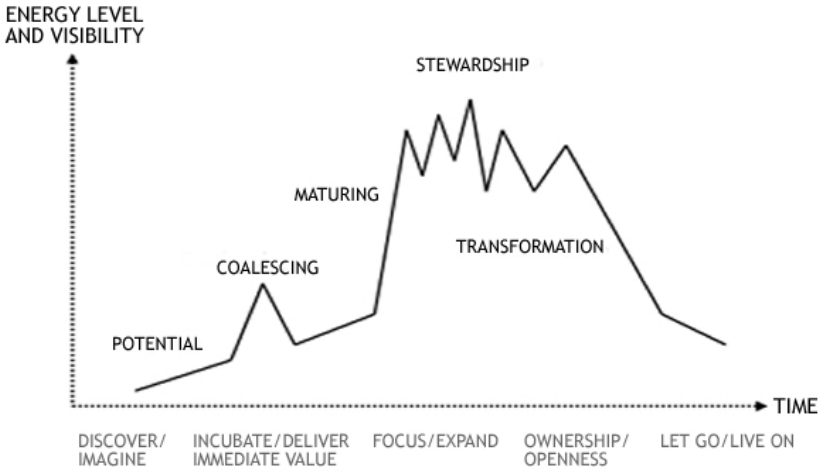

Figure 2.10: Virtual community of practice lifecycle
(Wenger et al., 2002a: adopted from Saint-Onge and Wallace, 2003)

The above mentioned stages are not allotted to a predetermined timeline. This is because different VCoPs have different rates of developing (Wenger, 2002a). The timeline is just presented to give a graphical representation of the different stages. This means that the focus of the VCoP lifecycle is on the level of energy and visibility.

Saint-Onge and Wallace (2003) have created a model which shows the growth dynamics of a VCoP (see figure 2.11 on the next page). This model makes clear that it is important to focus the community's value on its members, in order to let the VCoP develop.

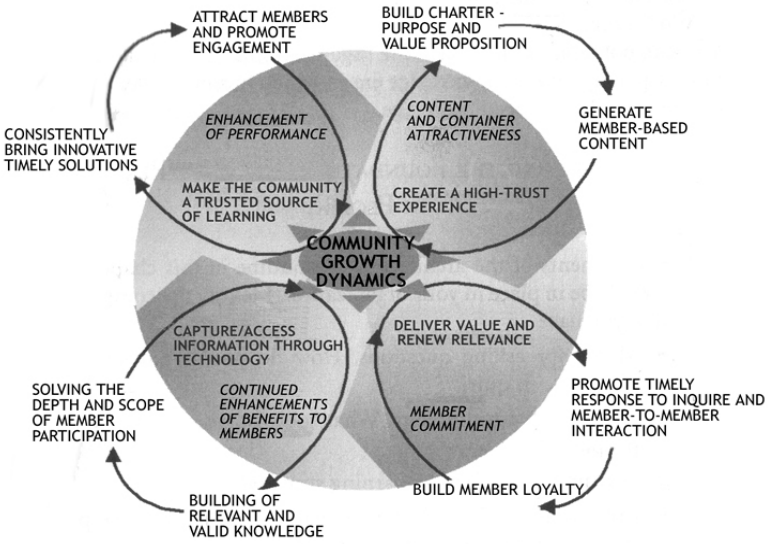

Figure 2.11: Virtual community of practice growth dynamics (Saint-Onge & Wallace, 2003)

To conclude this section and to understand the VCoP processes more clearly, Saint-Onge and Wallace (2003) have also developed a maturity model (see figure 2.12). Although the model is based on organizations, it can be used as a guide for other VCoPs. The horizontal axis represents the increasing use of collaborative technology, and the vertical axis represents increasing learning and collaborating abilities. The maturity model explains four different stages.

A VCoP begins in the 'sporadic emergence of community' stage. In this stage, awareness of being a CoP arises. The second stage is 'systematic building of communities'. In this stage, the vessels for collaboration and learning are established. Then the community moves on to the third stage. This stage identifies 'communities as an inherent part of the organization'. The community becomes a primary source for learning and knowledge creation. In the final stage, 'an effective balance between existing and new organization structures' can be identified. The community has a complete new organizational structure in this phase (i.e. it is completely made up of a network of different communities) (Saint-Onge & Wallace, 2003).

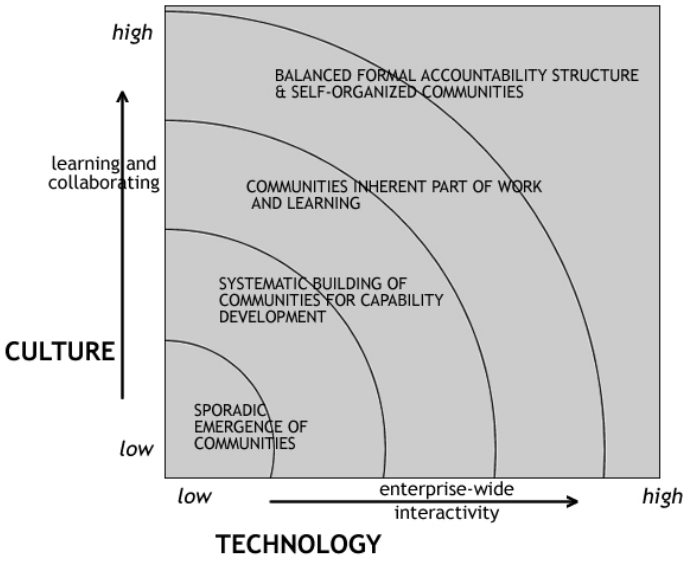

Figure 2.12: Maturity model: Communities of practice within an organization (Saint-Onge & Wallace, 2003)

2.3 Which factors play a role in virtual communities of practice?

When people are initiating the idea to create a VCoP, they want it to be a successful one. But what are the factors that are influencing a VCoP to become successful? This paragraph explains which factors are important to the success of a VCoP. This paragraph is necessary, in order to answer sub question four *(i.e. which factors determine the success of a virtual community of practice?)*. The results from this paragraph are, in a large extend, used to create the VCoP factor model, which is highlighted in paragraph 5.2.

The factors are categorized according to the key challenges McDermott (2000) presented in his study. This means that the factors that influence the success of VCoPs are described in four sections (see figure 2.13). First, the factors that are related to the community challenges are explained. After that, the factors related to individual community members (i.e. personal challenges) are highlighted. This is followed by addressing the factors related to management challenges. This section ends by presenting the factors that are related to the technical challenges of VCoPs. This structure is chosen, because the four challenges of McDermott (2000) provide a complete overview of factors that can come into play in VCoPs.

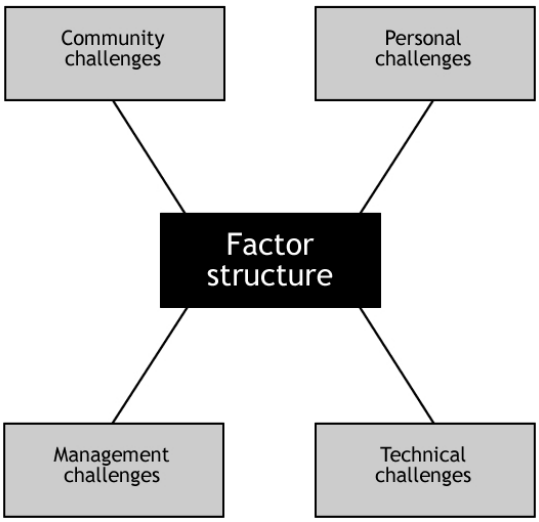

Figure 2.13: Structure of success factors

2.3.1 Community challenges

In this section the factors, which are considered to be community challenges, are described.

According to McDermott (2000), there are four factors which belong to community challenges. The first factor is to get though leaders involved. In order to build energy in the community, it is necessary to get respected thought leaders in the VCoP as quickly as possible. The second factor is to build personal relationships among community members. The key of ongoing success in a VCoP is the contact members have with each other, and the social connection that comes paired with it. Develop an active passionate core-group is the third factor. It is important that there is a selected group of people who feel responsible for the community. They are helping in the development process of the VCoP, and are trying to motivate the other community members to contribute as well. The final factor McDermott (2000) describes is to create forums of thinking together as well as systems to share information. In order to create a sense of community, community members need not only to share information amongst each other, but they must also communicate with each other.

Allen et al. (2003) have asked their participants what the top three reasons are of being involved in a VCoP. This top three is articulated as follows: professional relationships (e.g. getting help from different experts); volume of information (the VCoP is seen as an online encyclopaedia); and the productivity of the VCoP. The factors that were less important are: personal motives; the status of the VCoP; and the stability of the VCoP. Ardichvili et al. (2003) supplement this enumeration with, keeping informed with the general developments in the domain, managing work, and replacing physical meeting.

In their study, Allen et al. (2003) furthermore let members of VCoPs rank their community in relation with learning capabilities. VCoPs ranked highest in providing efficient idea exchange, generating a broad perspective on solving problems, providing greater access to experts, increasing member's knowledge and motivation to learn, and effectively helping others to learn. VCoPs particularly emerge to be on of the most proficient mechanisms for exchanging ideas, and receiving a broad perspective on issues at hand. Moreover, Allen et al. (2003) attribute that the quality of information is a factor that can enhance success in a VCoP (e.g. when information is inaccurate, or out of date, members will stop using the community). This is however contradictory with their finding that the volume (i.e. quantity) of information is considered to be very important as described in the section above.

Saint-Onge and Wallace (2003) found six factors that enhanced the success of a community when a VCoP was introduced. The introduction of a VCoP leaded to better agility (e.g. members are able to contribute to early discovery of trends and react with speed), more fruitful collaboration (e.g. results are achieved effectively), quality of speed and decision making (e.g. knowledge access and knowledge exchange (via technology) allow members to make better and faster decisions), accelerated learning and capability building (e.g. members have more opportunities for learning, which increases capabilities to meet market and business needs), coherence (e.g. members jointly make sense what is happening), and innovation (e.g. members create value by building on one another's ideas).

Saint-Onge and Wallace (2003) furthermore articulated seven benefits a VCoP could have for its community. These benefits are: governance of mechanisms; protocols and norms; knowledge creation and access; maintenance of community space; sub communities and connections between them; alignment with corporate strategy (if applicable); and advancement of the practice.

Allee (2002) has also found some benefits why VCoPs should be used. She obtained these benefits from her experience as a practitioner. The benefits for the community are: help building common language, methods, and models around specific competencies; embed knowledge and expertise in a larger population; aid retention of knowledge when members leave the community; increase access to expertise across the company; and provide a means to share power and influence with the formal parts of the organization.

Collaboration plays an important role in community challenges as well. Schunn, Crowley and Okada (2002) found that collaboration, both virtual and physical, has twelve benefits. These twelve benefits are descended from most important to less important: division of labour; different ideas; stimulating; increase enjoyment; challenging; motivating; different styles; different resources; increase speed of research; similar ideas; helps monitor progress; and research support.

Besides the benefits of collaboration, there are several circumstances that may lead to frustration. These circumstances are: communication problems; different ideas; slow research process; different styles; personality differences; assignment of credit problems; and motivational problems (Schunn et al., 2002).

Birnholtz (2005) investigated why researchers (i.e. scientists) currently collaborate in geographically dispersed and even multidisciplinary ways. He found three main reasons. In the first place it very likely to presume that researchers study phenomena and systems which are very complex. Second, it can be very useful to look at difficult problems from several perspectives. The third reason is that some fields of research have to deal with very complex, or massive, scientific apparatus, which are not always present at local facilities.

The positive effects could be significant when using a VCoP in geographically dispersed locations. Unfortunately there are several dimensions which can cause some barriers. Birnholtz (2005) addresses institutional and social obstacles in the system of scientific research (e.g. individual reputation; impact publications; and wide-spread recognition) which may be difficult to solve. This point only counts for VCoPs that are built on scientific grounds. Besides this point, he also addresses the non-effectiveness of mediated technologies that support collaboration. Walsh and Maloney (2007) complement these social factors by addressing scheduling issues, monitoring and coordination processes, informal communication, information flow (e.g. information security), and distinct cultures, languages, and world views (i.e. demographic differences often are accompanied with different beliefs). This can possibly produce a barrier, because it may influence the task processes, which can then result in conflicting opinions and interpretations (Pelled, Eisenhardt & Xin, 1999, cited by: Walsh & Maloney, 2007).

Trust is also noticed to be an important factor in community challenges (e.g. Jaarvenpaa & Tanriverdi, 2003; Preece, 2004; Ridings et al., 2002). Jaarvenpaa and Tanriverdi (2003) have found three reasons why trust is important. The first reason is that VCoPs can be limited by the uncertainty of its members. In order to cope with uncertainty, community members need trust. The second reason relates to conflict. Because members can have different motivations to participate, there could be a potential that conflict arises. Trust can manage or even avoid conflicts. The final reason associates technological constraints. Mediated communication can limit trust building, because the members can not see and observe each other. This is attributed by Preece (2004) as well. She mentions that trust, but also empathy and reciprocity are essential factors for members to unite and cooperate. However, this is not easy realizable in a VCoP. When members are engaged in chat sessions or in discussions on a discussion forum for example, there are no social cues of identity (e.g. physical presence or body languages).

Trust is also researched by Ridings et al. (2002). They have identified that trust in a virtual place has two dimensions. These two dimensions are: ability; and a combination of benevolence and integrity. In their point of view, ability is the skills and competencies to influence a specific area. Benevolence on the other hand is the expectation that the other community members will not harm to the trustee. Members who expose integrity expect from other community members that they will interact according to predefined social norms. The authors also tested some antecedents of trust in virtual communities and discovered the following results: the perception of member's responsiveness; the perceptions of the degree to which others confide personal information; and the disposition to trust, all relate positive to the trust in member's abilities, benevolence and integrity. They discovered that trust in the ability, benevolence, and integrity of others in virtual communities, relates positive to the willingness to give and receive information from others.

Furthermore, Ridings et al. (2002) mention that lack of face-to-face contact and other visual cues can lower the trust level within the community. Also identities of community members may be suspicious, because it is easy to make up identities online. Nevertheless, they think that mutual engagement and repeated interaction can enhance trust. Although identities may be suspicious, identity is an important factor for success in VCoPs (Preece, 2004). This is less of an issue considering communities who have already met in real-life. However, when community members have met and worked with each other in real-life, they may be redundant when participating in a VCoP (Ardichvili et al., 2003).

2.3.2 Personal challenges

This section deals with the factors which are perceived to be related to personal challenges.

The benefits for individual members to participate in VCoPs are: help people do their jobs; provide a stable sense of community with other internal colleagues and with the company; foster a learning-focused sense of identity; help develop individual skills and competencies; help a knowledge worker stay current; and provide challenges and opportunities to contribute (Allee, 2002).

People are motivated to engage in VCoP participation when better or new knowledge can be made available in the domain, or when knowledge can be created faster. This means for example that researchers can work better and faster on (scientific) papers. This is an important factor, because scientists in particular are very interested to get publication points. This means that the community, also in virtual form, needs to have a good reputation. Saint-Onge and Wallace (2003) state that fast knowledge creation furthermore results in the ability to sense and respond to changing markets and services, and that duplication effects can be eliminated.

Participation is defined by Wenger (1998) as a process of taking part, and going on relations with others in that process. Participation requires both action and connection. Butler, Sproull, Kiesler and Kraut (2002) found that people who are participating in VCoPs and are working on collective community building do so, because they expect to get something out of it. They also acknowledge that people want to gain access to information, which is relevant to their work. This information might otherwise be obscure or inaccessible to them.

According to Kollock (1996), three conditions have to be met in order for people to participate and cooperate in a VCoP. The first condition is that members of the VCoP have to meet or cooperate with each other in the future. If this condition is not met, members can behave in selfish matters. Therefore, ongoing interaction is needed. Another condition that needs to be met is that individual members must be able to identify other members. This second condition is also important considering selfish behaviour. The third condition holds that information about the behaviour of members should be made available. This allows members to respond to other members in an appropriate manner. This can also encourage the development of reputations. Kollock (1996) obtained these three conditions from the book of Robert Axelrod (1984) called 'The evolution of cooperation', and applied them to VCoPs. Kollock (1999) considers reputation as an important factor. When members contribute high quality information, give impressive answers to questions, are willing to help others, and have good writing skills, they can get an increased reputation within the community.

Two other obvious reasons for people to be motivated to participate in a VCoP are first of all the commitment one has with the community. The second motivation is to contribute useful information to the community and hope to get useful information back in return (i.e. reciprocity) (Kollock, 1999). The information in a VCoP needs to be updated frequently in order to encourage return visits. Allen et al. (2003) give ten additional reasons why members could be motivated to participate in a VCoP. These additional reasons are: asking and answering questions; chatting with experts; solving problems; making connections with other VCoPs; creating sub communities around a special interest topic; participating in presentations; networking; construction of a knowledge baseline; collaborating; and sharing best practices.

In a study about motivation and barriers in VCoPs, Ardichvili et al. (2003) concluded that the barriers of contributing knowledge in VCoPs had nothing to do with selfish behaviour. The greatest barriers for community members to not contribute are that they are afraid that their posts are not important enough, are not completely correct, or are not relevant to particular topics. Community members are anxious to lose face, or to let their colleagues down by possibly misleading them. New members believed that they had not the right to post. This barrier is related to the perceived unimportance of a post. These findings are not in line with the findings of Kollock (1996) in the section above.

According to Allee (2002), the benefits people have when participating in a VCoP are: bring problems of practice to the community; participate (e.g. in conversations); develop community conventions; establish links with other communities; and engage in personal and professional development. While it may seem that the individual members have a short list of roles, they are playing an important role in the community. If the members are not motivated and committed to the community, the community will have a relatively short life-expectancy (Allee, 2002). Allen et al. (2003) complement the benefits of Allee (2002) by the following factors: being able to apply knowledge to the job directly; increase job skills; increase knowledge; and use it as a source for problem solving.

Wasko and Faraj (2000) investigated the motivations of participation in a VCoP. They discovered the following motivations considering tangible returns: useful and valuable information; answers to specific questions; and personal gain (e.g. promotion; raises; and bonuses). Considering intangible returns: enjoyment; learning and self-efficacy; interaction with fellow community members and helping them; multiple viewpoints; having a peer group; keeping abreast of current ideas and innovations; social behaviour; reciprocity; maintaining the community; helping the community to advance to a higher level; and reputation and status. The authors made a critical note as well. If the community becomes too large, or the information exchanged is not relevant, community members are becoming unmotivated to participate, and might even leave the community.

Wasko and Faraj (2000) furthermore identified the underlying motivations of knowledge sharing within a VCoP. They did so according to two perspectives. When knowledge is viewed as a private good (i.e. owned by an organization or by an individual), people exchange knowledge through market mechanisms. These people are primarily motivated by self-interest and are less motivated to exchange knowledge when they get no tangible or intangible returns. When knowledge is seen a public good, community members do not exchange knowledge for self-interest or personal gain. Rather they exchange knowledge, because they feel that it is a fair thing to do, view at as a public duty, or have a concern for the community. Exchanging knowledge in this way is often a social process.

Ardichvili et al. (2003) also conducted research on knowledge sharing in a VCoP. Community members viewed their knowledge as belonging to the organization instead of themselves. In such perspective, members are motivated by moral obligation and community interest. However, there were some reasons to participate from a self-interest point of view as well. In such cases, members would like to position themselves as experts and gain recognition. Some community members, who reached a certain stage in their lives, declared that they found it was time to give something back by sharing their expertise, and by mentoring new members. This is in line with the findings of Wasko and Faraj (2000). Furthermore, community members are more willing to participate in VCoP when they trust that the VCoP is a source of reliable and objective information.

According to McDermott (2000), it is important to create real dialogue about cutting-edge issues. In order to form true relationships among community members, there should be room for discussion. Schraefel et al. (2000) go further and say that effective communication among community members in essence is the key element for successful collaboration in a VCoP.

Social relationships may grow when participating in a VCoP. This can be a huge motivation for community members to participate. When social relationships occur, trust is created, and exchanged information is seen as credible (Butler, et al., 2002). Moreover, the authors state that when community members value these social benefits, they might be encouraged to provide content and manage social behaviour. Coming to the heart of the matter, community members can become more visible. This is important considering work-related VCoPs, because it can lead to serious economical and/or professional benefits.

Ridings et al. (2002) further suggest, in consensus with Butler et al. (2002), that trust is a key element for community members to foster relationships with other members inside the community which they do not know. This is mainly due to the absence of workable rules that are set in co-located communities. In addition, it is implicated by the authors that trust is essential for a community to sustain.

2.3.3 Management challenges

In this section, the factors that deal with management challenges are described.

VCoPs are not only beneficial for the community and individuals, but can also be beneficial for organizations (Preece, 2004). VCoPs can help organizations to capitalize on global resources (e.g. globalization of business and business processes), increase the flow of information (e.g. increased communication opportunities), reduce costs (e.g. lowering overall training budget), increase training opportunities (e.g. recommending what kind of training is needed), and increase opportunities for innovation (e.g. more critical thinking) (Allen et al., 2003).

Some other benefits for the organization to use a VCoP are: help drive strategy; support faster problem solving, both locally and organization wide; aid in developing, recruiting, and retaining talent; build core capabilities and knowledge competencies; more rapidly diffuse practices for operational excellence; and cross fertilize ideas and increase opportunities for innovation (Allee, 2002)

Saint-Onge and Wallace (2003) complemented the benefits of Allee (2002) by the following benefits: endorse the community approach; provide effective technology infrastructure; nurture the community's evolution; encourage the creation of sub communities; steward the implementation of knowledge strategy; and model community principles of behaviour.

McDermott (2000) identified four factors which belong to management challenges. It is first of all essential to focus on topics that are important to the organization and to the community members. In order to show that the VCoP is important, it should be formed around relevant topics. The second factor is to find a well-respected community member to coordinate the community. In order to keep the community together, members who care about the community are needed. The third factor that is important considering management challenges is to make sure community members have time, and are encouraged to participate. Time is a very limiting factor considering participation in VCoPs. The last factor McDermott (2000) describes is to build on the core values of the organization. One must not try to change the culture of the organization in the scope of the knowledge management approach, but should adapt the knowledge management approach to the organizational culture.

Allen et al. (2003) state that there are six primary factors that determine the success of a VCoP. Of these six factors there are three that apply to management challenges, namely: well defined objectives and goals (e.g. when the expectations of the community members are not met, they stop using the community); the time one can spent in the community; and having enough support by management. The other three factors (i.e. the quality of information; the ability to apply community knowledge directly to the job; and having access to technologies) are described in the other sections.

Stuckey and Smith (2004) conducted interviews with several community leaders from six different VCoPs. From these interviews they revealed three directions that should be taken, in order to develop a successful VCoP. These three somewhat abstract directions are: sustain the community's being together inside the community (i.e. the quality and focus of contributions should be preserved); maintain boundaries around the community that are clear, permeable and meaningful (i.e. the community's identity should be maintained); and carefully draw nourishment from the environment and respond to challenges creatively (i.e. to sustain the community's work, nourishment (e.g. new contributions) is needed).

Despite the flexibility of VCoPs, most of them fail. Beenen, Ling, Wang, Chang, Frankowski, Resnick and Kraut (2004) illuminate that a major barrier for VCoPs is under-contribution. This is a problem for all VCoPs, even for those who are surviving. They state that it is important, in order to motivate community members to contribute on a regular basis, that technical features and social practices are carefully designed. They also found some interesting results according to the goal-setting theory. They found significant support for their hypotheses that specific and numeric goals motivated community members in a VCoP more to contribute, than non-specific goals. From a collective-effort perspective they found that members are motivated to contribute more when the uniqueness of their contributions is recognized.

Carotenuto et al. (1999) mention something that may counter under-contribution (i.e. it will enhance motivation to contribute). They state that systematic processes should be developed. When the members of a VCoP participate regularly, three objectives can be met. First, community members perceive that participating in a VCoP is a good and worthy activity. Second, it will reduce community member's fear of the unknown. And thirdly, when participation is embedded in the member's system, the likelihood is increased that they continue to contribute in the future. This is also attributed by Birnholtz (2005). He found that an increased frequency of network-based collaboration tool usage correlated positive with the tendency for collaboration. Wenger et al. (2002b) call this 'creating a rhythm for the VCoP'.

Tarmizi, de Vreede and Zigurs (2006) identified several challenges in establishing and sustaining CoPs. The challenges they found, which might not be completely inclusive are: making a case for CoPs; finding common interesting topics for community members; securing trust of shared information; lowering barriers among members to get involved in knowledge-sharing activities; recruiting the right members; and sustaining member's participation. They state that when these challenges are overcome, the CoP will survive. It is plausible that these challenges also count for VCoPs. Butler et al. (2002) furthermore strive for the importance of time and effort. A key challenge is to induce members of a VCoP to really perform the wished for activities. However, Dubé et al. (2006) consider the gathering of members, the identification of interest, the selection of tools, and the development of norms and processes as very difficult to achieve.

The final factor which can be presented here is budgets. Having a lack of budget can make a VCoP very vulnerable. Leaders of the community must be prepared to invest time and money in the VCoP, in order to let it reach its full potential (Wenger & Snyder, 2000).

2.3.4 Technical challenges

This section deals with the technological aspects of a VCoP.

A result of a successful VCoP is that it will sustain. A huge part of sustaining a VCoP is done by technology. Technology supports social interaction which makes community members motivated to carry on with the VCoP over an extended period of time. Social interaction is essential for sustaining a VCoP, because, unlike members in real-world communities, members in virtual communities can easily leave (Butler et al., 2002). Butler et al. (2002) state, that at least four kinds of social behaviour are necessary. Members of a VCoP should tend to technology themselves (e.g. keeping things up-to-date), should retain other members (e.g. by external promotion) in their VCoP, in order to balance its size (i.e. replacing the members that leave), should manage social dynamics (e.g. presenting protocols and norms; managing disputes; and discourage off-topic discussion), and should participate (i.e. creating and consuming content). If these conditions are not met, a VCoP is destined to fail, even though advanced technology has been used.

When a physical community is transferred to a virtual setting there are two opposing forces that can come into play. Members are not happy moving from physical to virtual meetings, and are willing to go back to the old method. Nonetheless, previous community experiences may remove these kinds of uncertainties, and the community can start to work virtually without any problems. Experienced communities (i.e. communities that have worked and interacted in real-life) have an advantage over newly created communities (Dubé et al., 2006). It is like Ardichvili et al. (2003) state, it is not a challenge to create a VCoP, but to remove the barriers.

Easiness of use is according to McDermott (2000) a very important factor considering overall VCoP usage. Contributing to, and accessing the community's knowledge and practices, should be made as easy as possible. Moreover, contributing to the VCoP should take as little effort as how things are done in daily practices. Allen et al. (2003) mention that having access to technologies, in order to communicate (i.e. when having the right tools available, the VCoP will work), is also an important factor for VCoP usage.

Before community members are going to participate in a VCoP, they first need to be motivated to do so. Various motivations can be found in the former sections. However, the acceptance of technology by which they are going to participate, is also an important factor. Venkatesh, Morris, Davis and Davis (2003) conducted an empirical study, in order to combine eight user acceptance models into one. The have called their theory 'the Unified Theory of Acceptance and Use of Technology' (i.e. the UTAUT model). The eight models they have combined are: Theory of Reasoned Action; Technology Acceptance Model; Motivation Model; Theory of Planned Behaviour; a model that combines the Technology Acceptance Model and Theory of Planned Behaviour; Model of PC Utilization; Innovation Diffusion Theory; and Social Cognitive Theory. The UTAUT model outperforms the other eight models and explains 70% of the variance. In figure 2.14, the UTAUT model is presented. The most important reason to use this theory is because of its explaining attitude.

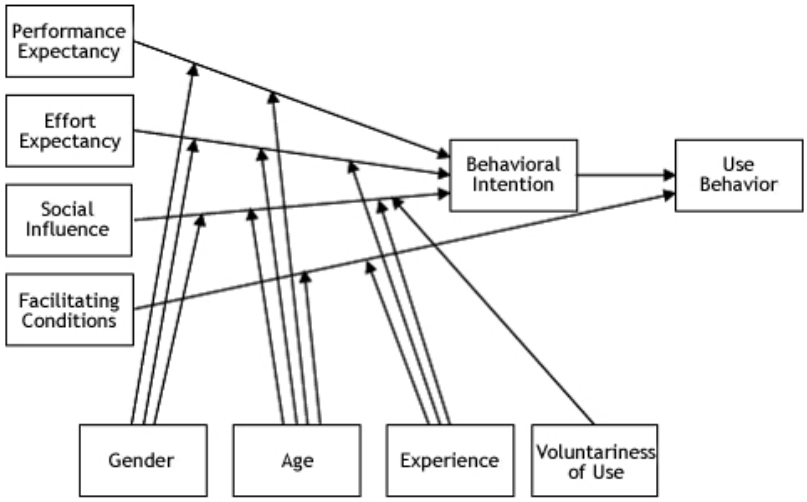

Figure 2.14: UTAUT model (Venkatesh et al., 2003)

In the UTAUT model, performance expectancy (i.e. the degree to which one believes that using the system will help becoming better in their job), effort expectancy (i.e. the ease of use of the system), social influence (i.e. the degree to which one perceives that important others believe he or she should use the new system), and facilitating conditions (i.e. the beliefs that an organizational and technical infrastructure will support the system) are the direct determinants of user acceptance and usage behaviour. The direct determinants of user acceptance and usage behaviour can be influenced by four variables. These variables are: gender; age; experience; and voluntariness of use (Venkatesh et al., 2003). The authors state that facilitating conditions are not influencing behavioural intentions, because of the presence of both performance and effort expectancy.

2.4 Conclusion

The conclusions are presented according to the construction of this chapter. This means that the answers to the three paragraph questions are given.

What are virtual communities of practice?

Sub question one *(i.e. what theoretical concepts can be obtained from current literature that will explain the virtual community of practice concept?)* can now be answered.

A VCoP, as described in this thesis report, is an interdependent network of physically distributed individuals over an extended period of time, which are characterized by having a joint enterprise to further practice and/or become better in job, by mutual engagement to do things together, like sharing knowledge and expertise, by a shared repertoire, which contains the constructed knowledge of the community, by a virtual place, where community members interact and cooperate with each other, by a netiquette, where the community specific protocols and norms are described, and by using technology for the primary means of communication.

How do virtual communities of practice develop?

This chapter made clear, by using the results from three studies, which steps are needed, in order to set up a VCoP. This means that sub question three *(i.e. which practical concepts can be obtained from current literature that will explain the steps that need to be conducted, in order to set up a virtual community of practice?)* can be answered. The steps are presented in underlying table (see table 2.2).

Steps	Allen et al. (2003)	Saint-Onge & Wallace (2003)	Preece (2000)
1	Identifying purpose and need	Defining the community project	Defining community needs and user tasks
2	Deciding how to measure success	Establishing the community components	Selecting technology and plan for sociability
3	Identifying tools and infrastructure	Launching the virtual community of practice	Designing, implementing and testing prototypes
4	Developing a business case	Establishing the community	Refining and tuning sociability and usability
5	Getting organizational support	Checkpoint: assessing progress and value	Welcoming and nurturing the community
6	Establishing structure	Growing the community	
7	Establishing membership	Evaluating purpose and directions	
8	Conducting a pilot test	Expanding the community	
9	Evaluation and revision		

Table 2.2: The steps from literature how to create VCoPs (Allen et al., 2003; Saint-Onge & Wallace, 2003; Preece, 2000)

Furthermore, the phases a VCoP can be in are presented in this chapter. Wenger et al. (2002a) described five phases in their VCoP lifecycle. These five phases are presented in underlying table (see table 2.3 on the next page).

Phase	Description
1. Potential	People with similar issues and needs find each other and identify the potential for forming a community.
2. Coalescing	The community is formed as activities develop to meet the needs of the community members.
3. Maturing	Community members begin to plan directions, set standards, and engage in joint activities. The value of the community has been established. It begins to clarify its focus, role, and boundaries. The community is the most active in this phase.
4. Stewardship	The community begins to plateau. Although energy and activity continue, members who were once enthusiastic may take a sideline position. The main issue for the community is to sustain its momentum, and to recognize the natural changes in practice, membership, and relationship (to the organization). However, the community itself still has some power.
5. Transformation	Community members leave the community when it is no longer useful or pertinent to them. New people join and the focus changes, returning the community to a new growth stage or moving towards closure. The experiences are maintained though.

Table 2.3: The phases of a virtual community of practice (Wenger et al., 2002a)

Which factors play a role in virtual communities of practice?

The main research question addressed in the beginning of this thesis was: "*which factors determine the success of a virtual community of practice for European research projects?*"

When carefully examining the factors mentioned in paragraph 2.3, it is realized that there are many individual factors which are considered to be influencing the success of VCoPs. This means that these factors also have the possibility to influence the success of VCoPs for European research projects. An overview of the total number of factors can be found in Appendix II. After analyzing the factors, the factors could be reduced to twenty-nine. These factors are presented in figure 2.15. Some factors may seem slightly abstract, as how they are described in the underlying model, but they are complemented by key words that will illustrate them more clearly when doing research (see also Appendix IV.I).

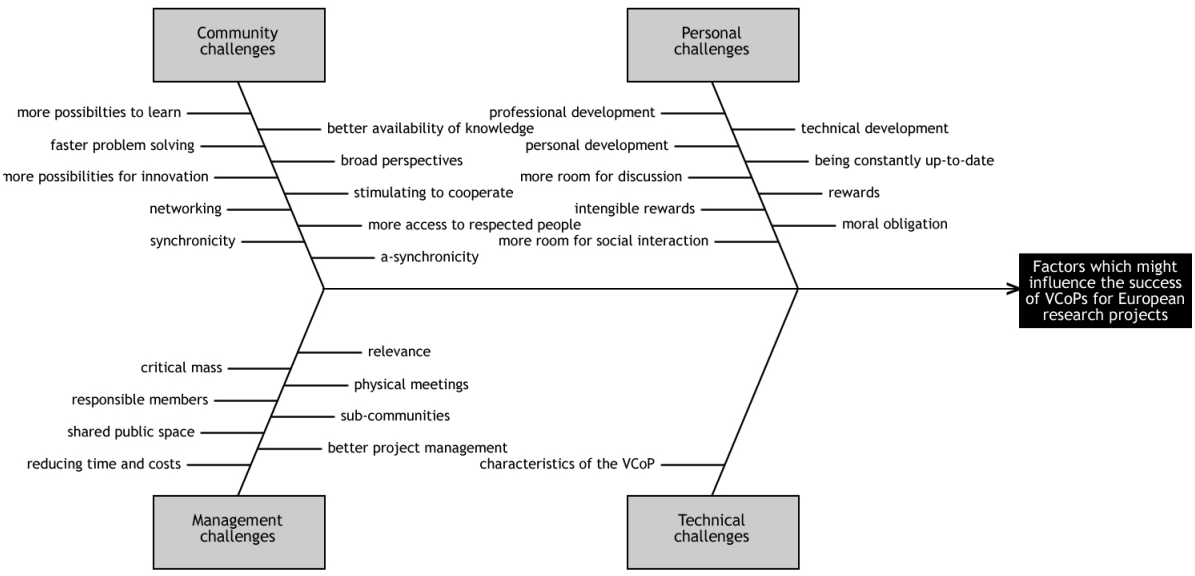

Figure 2.15: Factors which might influence success of VCoP for European research projects

The figure on the page above makes clear that sub question four *(i.e. which factors determine the success of a virtual community of practice?)* is answered. In order to find out which factors determine the success in VCoPs for European research projects (i.e. sub question five), some research needs to be conducted. This is treated in chapter four.

The VCoP factor model is made by using the principle of a fishbone diagram (i.e. cause-and-effect diagram). This is done, because the causes for a certain effect are easily identified, the format is ordered and easy to read, the knowledge of the process is increased, and it identifies areas of collecting data. A fishbone diagram is a graphical illustration of the relationship between a given outcome and the factors that are influencing the outcome (SaferPak Ltd. [SPL], n.d.). The classification is done on the basis of the structure used in the former paragraph.

Furthermore, when constructing the theoretical framework, the researcher asked himself some questions to what he has been writing so far. These questions were translated in two hypotheses.

In section 2.1.2 it is made clear that CoPs can have different sizes. This means that VCoPs can have different sizes as well. Would the influence of the factors, which determine the success of a VCoP for European research projects, be dissimilar in different VCoP sizes? To give this question more muscle, the following hypothesis is originated:

H1: *The influence of the factors, which determine the success of virtual communities of practice for European research projects, depends on the size of the community.*

In section 2.2.3 the phases a VCoP might encounter are described. When considering the phases of a VCoP, a comparable question can be formulated. Would the influence of the factors, which determine the success of a VCoP for European research projects, be unalike in the different phases a VCoP can be in? To strengthen this question, the second hypothesis can be formulated as follows:

H2: *The influence of the factors, which determine the success of virtual communities of practice for European research projects, depends on the phase the community is in.*

Thus far, it is made clear what VCoPs are, how they develop, and which factors play a role in VCoPs. In the following chapters this goes a bit further. The steps how to set up a VCoP and the phases how VCoPs evolve, are carefully analyzed. This leads ultimately to the VCoP process model (see paragraph 5.1).

The factors that are described in this paragraph are tested if they are also influencing VCoP success for European research projects. This leads to the VCoP factor model, which is described in paragraph 5.2.

In order to construct both models, some research is needed. The research methods that were conducted, in order to realize these models are described in chapter four. Before entering the fourth chapter, first a close look on the practical case of this thesis is given.

3 THE SCORE! PROJECT

It is no use saying, 'we are doing our best' - you have to succeed in doing what is necessary (Winston Churchill)

The practical part of this thesis deals with the SCORE! project. The SCORE! project, which stands for Sustainable Consumption Research Exchange, is a networked project and is funded by the European Commission Sixth Framework Programme (further referred to as FP6) (the Netherlands organization for applied scientific research TNO [TNO], 2005).

The SCORE! project started in October 2005 and will continue to April 2008. SCORE! is set up to support the United Nations' ten year framework of programs on sustainable consumption and production (further referred to as SCP). The development of this ten year framework is leaded by UNEP and UN DESA. This is done through the Marrakech process. Marrakech taskforces, which are initiated by national governments with participation from all regions in the world, have been established to develop and test policies on sustainable procurement, sustainable product policy, sustainable tourism, sustainable building and construction, education for SCP, SCP cooperation with Africa, and sustainable lifestyles. This framework is agreed upon by world leaders during the 'World Summit on Sustainable Development' in Johannesburg, South-Africa, in 2002 (TNO, 2006).

This chapter is used to describe the SCORE! project and its community. This is necessary, in order to understand the practical case this thesis deals with. In the first paragraph, the mission, philosophy, and the objectives of SCORE! are highlighted. The structure of the SCORE! community and the characteristics of its members are addressed in the second paragraph. In the third paragraph, the question is addressed if a VCoP could fit within the SCORE! project.

3.1 The mission, philosophy, and objectives of SCORE!

SCP is key policy priority world-wide. The mission of SCORE! is to organize a leading science network on SCP. It will involve and structure a large community. The SCORE! community currently contains a few hundred innovation scientists and/or professionals (further referred to as experts), who are mainly located in Europe, and who are active in the field of SCP and related professions. These experts are spread over twenty-eight institutions (TNO, 2006).

SCORE! aims to understand how our consumption structures can become radically more sustainable. This requires excellent insights in key knowledge fields related to SCP value chains. These value chains are: new business development; sustainable design; consumer research; and system innovation policy. The experts who are engaged in these four knowledge fields are working together. The SCORE! project occupies itself in three priority consumption domains. These three consumption domains are: mobility; agro-food; and energy consumption (see figure 3.1 on the next page). These domains are responsible for 70% of the impact on the life cycle environment in Western societies (e.g. car-driving; meat consumption; energy for cooking; and heating and cooling) (TNO, 2005).

In short, it could be said that the philosophy of SCORE! assumes that SCP structures can only be realized if experts, who understand new business development (i.e. sustainable design; consumer behaviour; and system innovation policy), work together in shaping them. Moreover, the activities of SCORE! have to be linked to real-life consumption areas. If the development of SCP structures is not linked to real-life consumption areas, it will become only a theoretical exercise, while industrial exercise is preferred predominantly (TNO, 2005).

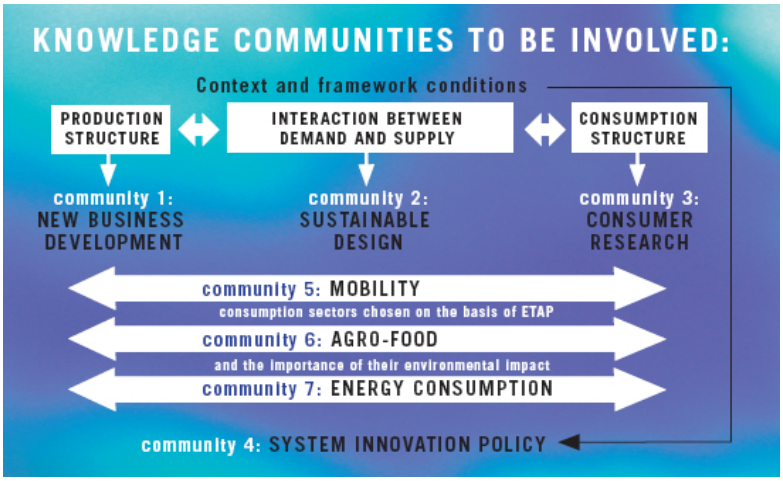

Figure 3.1: SCORE! knowledge communities (www.score-network.org)

A network which coordinates research and innovation in the SCP field was not present. In order to make sure that coordination in the field of SCP emphasizing user awareness for SCP is realized, the SCORE! project has four main objectives. These objectives are: generating and dissemination of best practice; programming research (e.g. coordination of existing research and identification of priority research needs); forming a platform for practical and scientific input into relevant policy trajectories; and building a structural network of European SCP experts. The structural network should break across boundaries of scientific disciplines, boundaries of academic research, applied research, and innovation at business level, and geographical boundaries (TNO, 2005).

SCORE! has already booked some successes. One of its successes is that there are many people working on content for the SCORE! project. This is done by voluntary initiatives. Furthermore, many people who want to subscribe to SCORE! There are even initiatives from people outside the European Union who want to adopt the SCORE! model. To sum up, it can be said that SCORE! is taken very seriously. This is important, in order to get the domain of SCORE! on policy agendas.

3.2 The structure of the SCORE! community

As stated before, the SCORE! project is funded by the FP6. In order to outline the SCORE! project it can be defined as 'Specific Support Actions'. More information about the FP6 and Specific Support Actions can be found in Appendix III.

The SCORE! community currently exists out of three main groups (see figure 3.2 on the next page). The first group is called the co-ordination team, which is the project team of SCORE! This group contains ten people, which are leaded by Dr. A. Tukker and Drs. S.B. Emmert (i.e. the project managers). The other eight persons are from the United Kingdom, Italy, Norway, Denmark, Belgium, Germany, and France. This group is getting funds from the European Union (i.e. they are paid to contribute to SCORE!), and is writing substantive books about the project's domain.

In the second group, the SCORE! members can be identified. The SCORE! members are part of twenty different organizations and universities who are committed to the SCORE! project. They are also scattered across the different regions of Europe. They get some monetary compensation as well, so it is expected from them that they contribute to SCORE!

The third group is called the community. The community holds several hundred people from different parts of the world (mainly Europe) that are specialized in the SCP field, or in particular parts of that field. This group does not get monetary compensation.

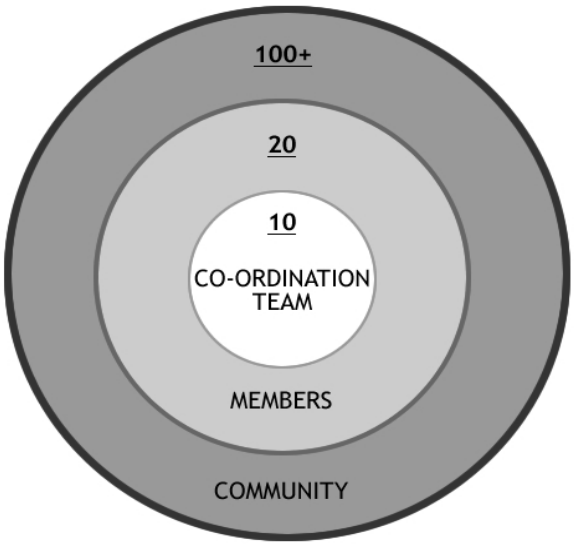

Figure 3.2: The SCORE! community

Throughout this report, individuals who are part of the SCORE! project are called 'SCORE! members'. In collective expressions, the term 'SCORE! community' is used.

3.2.1 Membership characteristics of the SCORE! community

When dealing with a practical case like this, it is meaningful to understand what kind of people are part of SCORE! In this section, the SCORE! members are carefully described.

In a broad sense it can be said that the members of the SCORE! are highly skilled and creative experts in the field of SCP. The SCORE! members have busy lives combined with busy schedules and do not have time for insignificant tasks. They all have a shared interest in the domain of SCORE! and are willing to contribute to it. However, it is also important to them to get something out of it. Most SCORE! members are working voluntary, and with much enthusiasm, on project related tasks. The membership characteristics are explained in more detail by using the typology of Dubé et al. (2006).

According to the typology of Dubé et al. (2006) the membership characteristics of SCORE! can be described according to ten points. These ten points and the SCORE! specific descriptions are presented in the table below (see table 3.1).

Membership characteristics	SCORE! specific characteristics
Membership size	The overall membership is of moderate size. SCORE! has over a hundred members and a core-group of ten.
Geographic dispersion	The geographic dispersion of the SCORE! community is high. The SCORE! members are from different parts of Europe.
Selection process	The selection process of community members is primarily open. Everyone who is interested can become part of the SCORE! community. Conversely, the membership of the co-ordination team and the SCORE! members are closed.
Enrolment	The enrolment of members is voluntary. People are not forced to become a member of the SCORE! community. However, the SCORE! members and the co-ordination team of SCORE! have some compulsory characteristics. It is expected from them that they contribute to the SCORE! project.

Prior experience	The prior community experience of the SCORE! members are extensive. The community members are part of SCORE! before the VCoP is created.
Stability	The memberships of SCORE! are stable. SCORE! has permanent members who are working on the project. However, this can change in April 2008 when the SCORE! project officially ends.
Cultural diversity	The cultural diversity in the SCORE! community has two levels. The cultures that can be distinguished are: professional and national cultures. The professional culture is moderately homogenous (i.e. the expertise and background of the SCORE! members might be different, but they are all working in the same domain). The national culture on the other hand is heterogeneous (i.e. the SCORE! members are dispersed all over Europe).
Topic's relevance	Topic's relevance to the SCORE! members is high. Because SCORE! is a voluntary community, people themselves determine to become a member or not. If the topic would not be relevant, people would stay away from it.
ICT literacy (i.e. not being able to use technology efficiently)	Member's ICT literacy was assumed to be low, which is good. The SCORE! members have a scientific background, and are supposed to be experienced with mediated communication tools. Despite this fact, low ICT literacy is not always the case. With relatively new technologies (e.g. video conferencing), community members could have high ITC literacy. This means that they are not always comfortable using the technology. Nevertheless, it is believed that they adopt technology fast, especially when they see its value.
Reliance on ICT	The degree of reliance on ICT and ICT availability are low. A virtual place, like a VCoP, is not yet available. However, there is a SCORE! web site. The reliance on the web site is minimal. The SCORE! members only have to use the web site to register for events, and find documents that explain the actions that need to be done for the SCORE! project.

Table 3.1: SCORE! specific membership characteristics

3.3 The current state of the SCORE! project

Before the researcher started writing this report, there was already a web site available for SCORE! It included some basic functionality, like searching for information, registering for events, and it had a discussion forum on board.

Although the availability of a SCORE! web site and a discussion forum, it was practically unused. The project managers of SCORE! needed something comparable, though differently to replace their web site.

The idea was to develop a VCoP for SCORE! and its members. In chapter two, VCoPs were carefully explained. However, it is questionable if a VCoP is the right solution for SCORE! In the next section it is made clear if it is wise to develop a VCoP for the SCORE! project. Also the goals of the VCoP for SCORE! are addressed in this section.

3.3.1 Can SCORE! actually become a VCoP?

In order to answer the question if SCORE! can actually become a VCoP, it first needs to meet the characteristics of CoPs, which were described in section 2.1.1. SCORE! can not yet be compared with the characteristics of VCoPs, because it is not yet in this stage.

First of all, the SCORE! community is compared with the three key elements that define a community as a CoP. The first key element is joint enterprise. The SCORE! community is working on a shared domain of interest (i.e. SCP). This is what keeps the community together. The members of SCORE! are also trying to create shared accountability, interpretations and the like. The second key element is mutual engagement. The members of SCORE! are interacting together and learning from each other. They are all engaged in actions that are central to the community. The third key element is called shared repertoire. The members in the SCORE! project are developing a shared collection of resources. This can be experiences, tools, books, stories, and the like. The analyses of these three key points confirm that SCORE! can be viewed as a CoP.

In section 2.1.1, Saint-Onge and Wallace (2003) identified three types of CoPs. However, SCORE! can not easily be defined in one of those categories. In the phase SCORE! is now, it can be assumed that SCORE! falls for a great part under 'structured CoPs'. Because, SCORE! is not a business organization, but a European research project, it partly falls under 'supported CoPs' as well. All characteristics of these two types of CoPs are overlapping each other.

To make it even more difficult, when the project officially comes to an end, the type of CoP will change. When SCORE! reaches this stage, it will become a combination of both 'structured CoPs' and 'informal CoPs'. The informality of the CoP depends on the goals of the VCoP when the project is finished. One thing that will not change, although the SCORE! VCoP might be highly informal, is that the members will use mediated communication as a primary way to communicate, in stead of physical communication.

According to the virtual community typology of Porter (2004) (see section 2.1.2), the virtual community of SCORE! which is going to be created, can be defined as a member-initiated virtual community. The relationship orientation in the SCORE! virtual community will be professional. This means that the virtual community can be considered a VCoP.

Now the SCORE! community is recognized as a CoP, it is acknowledged that there can be made a case to actually become a VCoP as well. The SCORE! VCoP can become a primary source for learning and knowledge creation around its domain. It should provide a technology platform with sufficient tools for communication and collaboration. The knowledge base should be increased, and the members of SCORE! should be able to learn from each other. The VCoP can create many opportunities for fast innovation and solution finding (Saint-Onge & Wallace, 2003).

Setting up a VCoP for the SCORE! project will not be done without purpose. There are four main purposes why the SCORE! VCoP should be set up. These purposes are:

- It will be the first VCoP around sustainable consumption and production
- It will make cooperation between physical meetings more effective and efficient
- It will make publicizing of research more easily
- It will maintain the community when the SCORE! project officially ends

In order to set up a VCoP for SCORE! the information from this chapter is not inclusive. For that reason some additional research is needed. This is explained in chapter four.

4 RESEARCH METHODOLOGY

The important thing is not to stop questioning - curiosity has its own reasons for existing (Albert Einstein)

In this chapter, the main research question *(i.e. which factors determine the success of a virtual community of practice for European research projects?)* and the sub questions from section 1.1.5 are elaborated upon. The methods that were needed, in order to get an answer to the research questions are presented in this chapter.

According to Verschuren and Doorewaard (2000), information that is needed to answer the research questions can be retrieved from two objects. These objects are: people; and situations, artefacts, and processes. Within these objects there are five sources of information. These five sources are: literature; documents; persons; media; and reality. In this thesis, information that was needed, in order to answer the main research question and the sub questions were gathered from four sources, namely: literature; documents; persons; and media. Because the literature review has already been conducted (see chapter two) it is not specifically addressed within this chapter. Document review has also been conducted (see chapter three) and is not addressed in this chapter either.

The research methodologies that are addressed in this chapter are: survey with researchers; cluster experiment with researchers; interview with SCORE! members; survey with SCORE! members; and field test with SCORE! members. The research methodologies and their objectives are presented individually. Each method is accompanied by a research scheme, which explains how the methods were conducted. The research methods are presented in the figure below (see figure 4.1). The primary goals of each method are presented within this figure. The black boxes represent the methods that were needed to suffice the theoretical part of this thesis, whereas the blue boxes represent the practical part.

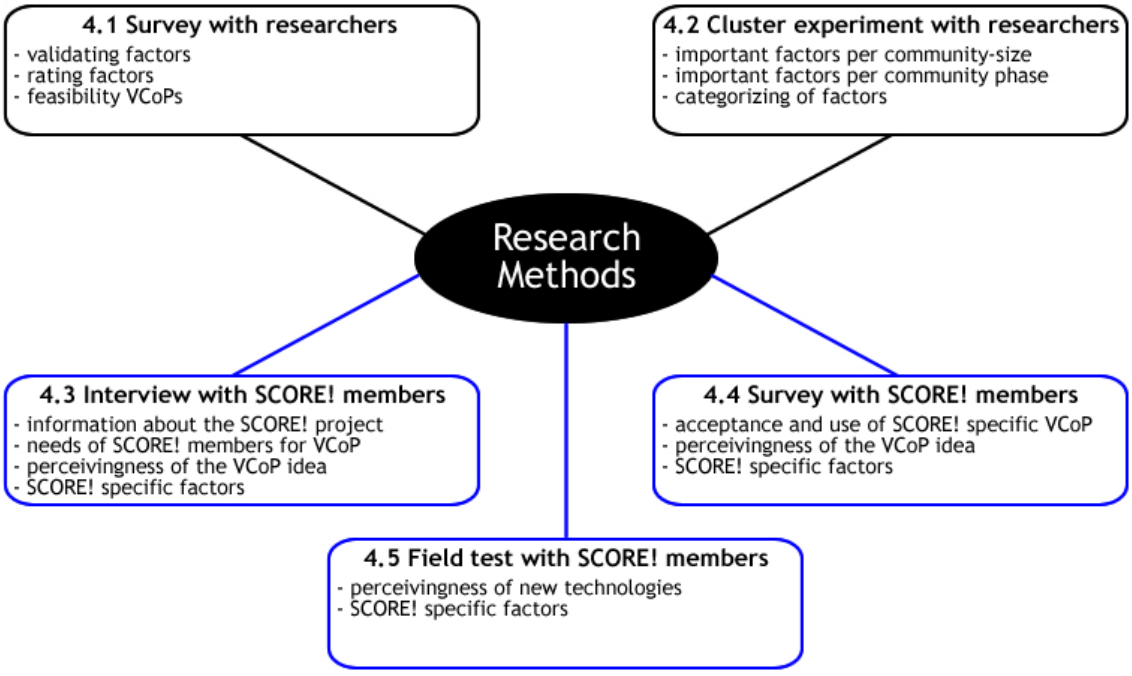

Figure 4.1: Research methods

4.1 Survey with researchers

Factors play an important part in the main research question. The factors, which influence the success of a VCoP in general, were obtained from literature. However, in order to understand which of those factors are important to VCoPs for European research projects they needed to be validated. This was necessary, because the factors were obtained from different perspectives. Furthermore, the survey was necessary in order to understand if VCoPs are perceived as feasible instruments for European research projects by their (future) users (i.e. researchers).

A survey was conducted in order to solve these issues. A survey is a quantitative method, and is used to collect data from people by using questionnaires (Dooley, 2001). The survey design used here is a cross-sectional design. In a cross-sectional design, the survey is only used at one time point to collect data. The findings of the survey can only be generalized during the time of the survey (Dooley, 2001).

4.1.1 Research scheme survey with researchers

The survey tried to solve sub question two and five. Sub question two deals with the feasibility of VCoPs for European research projects, whereas sub question five deals with the factors that enhance success in such VCoPs.

Sub question two *(i.e. how do researchers perceive the idea to work with a virtual community of practice in European research projects?)* was important to integrate in this survey, in order to find out if VCoPs are welcomed by researchers to use in their European research projects. This sub question could be specified into the following questions:

- *Do virtual communities of practice for European research projects provide added value according to researchers?*
- *Is the integration of a virtual community of practice in European research projects realistic according to researchers?*
- *Will researchers actually use a virtual community of practice for European research projects, once it is made available?*
- *Will researcher put their own energy in the development process of a virtual community of practice for European research projects?*

Sub question five *(i.e. which factors, which determine the success of a virtual community of practice, can be attributed to virtual communities of practice for European research projects?)* was important to integrate as well. This question was necessary, in order to find out which factors are important to VCoP success for European research projects. It also identifies how important the factors to this specific VCoP are. This sub question could be specified in the following questions:

- *Which factors, which determine the success of virtual communities of practice, can be validated by researchers?*
- *Which factors, which determine the success of a virtual community of practice for European research projects, can be obtained from researchers?*
- *How influential are the factors, which determine the success of virtual communities of practice for European research projects?*

The factors, which were obtained from paragraph 2.4, were randomly ordered in the questionnaire. Each factor was accompanied by two or three key words that described the factor. By doing this, the interpretations of both the researcher and the respondent should be the same. The factors could be rated on a three point Likert-scale, with on the left side of the scale 'not important' and on the right side 'very important'. A three point Likert-scale was chosen to make the ratings more meaningful. The researcher made sure that the factors, which influence the success of VCoPs for European research projects, would be validated, and that the level of importance per factor was made clear. In this way, unimportant factors could be descended and a distinction could be made between success factors and slightly important factors.

In order to make sure that no factors were over-looked by the researcher, there was a question inserted which gave the respondents the opportunity to think about factors that could enhance the success of a VCoP for European research projects.

The questionnaire started with a situation sketch. This was included, because it was perceived by the researcher that it would be difficult for the target group to form a clear image of a VCoP. By presenting a situation sketch, the target group could develop a mental model of a VCoP. This should make it easier to answer the related questions. General questions like age, sex, and experience were included to discover possible correlations.

Before the questionnaire was send out, it was pre-tested twice. This was done in order to make sure that the questionnaire was reliable. The questionnaire was tested on inconsistencies, the interpretation of the questions, the understanding of the questions, the order of the questions, and on the adequateness of the instructions. The first pre-test was done by two people, and it resulted in the following changes: the questionnaire was translated from English to Dutch, in order to make the questionnaire less difficult to fill in; the additional option to choose 'no opinion' was left out, because the three point Likert-scale itself provided a comparing option; and one question was modified, because it was perceived to be confusing.

When the changes were applied to the questionnaire, it was pre-tested again by two (other) people. It still leaded to some improvements. The respondents were asked to read a 'scenario' before they started answering the questions. The word 'scenario' was transformed into 'situation sketch', because a scenario has a completely different meaning at TNO. The last point of improvement was to delete the factor names and to only keep the description (i.e. the key words). The factor names could be confusing, while the description would be better interpreted. However, the researcher rejected this change, because the individual questions would become spurious once that change was made.

The questionnaire was distributed electronically using the email system of two locations (i.e. the ICT, and the Building and Construction location) of TNO. The email contained a short description of the contents of the questionnaire. A week after the first email, a reminder was sent in order to get more respondents. To get a good quantitative sample, at least 50 respondents were needed. When the questionnaire was closed down after two weeks it was online, 102 questionnaires were returned. In total, 87 responses could be used, which means that a satisfying sample was gathered. The questionnaire was constructed by using 'Thesis Tools' (www.thesistools.com). The results were automatically saved in a Microsoft Excel file, which could be easily imported in the 'Statistical Package for the Social Sciences' (i.e. SPSS).

The results from this survey helped setting up the VCoP factor model, which is described in paragraph 5.2. The survey design can be found in Appendix IV.I. The survey was conducted in Dutch, but is presented in English, because that is in line with the language of the report.

In addition, a colleague at TNO tipped the researcher by sending him an email that three colleagues of him had experience with VCoPs for European research projects. Because it seemed fruitful to gain some extra practical insights, the researcher tried to contact them, in order to conduct an interview. Two out of three colleagues could be contacted, and positively reacted on doing an interview. The interview design can be found in Appendix section IV.VI. The interview research scheme is not implemented in this chapter, because the interviews were not originally designed in this thesis.

4.2 Cluster experiment with researchers

The cluster experiment lies in the continuum of the survey that was conducted with researchers. The cluster experiment can be viewed as an interview with some small tasks for the participants to perform. The cluster experiment provided added (qualitative) value above the results of the questionnaire. The cluster experiment was conducted with eight researchers from TNO, who are active in the Innovation and Environment sector.

4.2.1 Research scheme cluster experiment with researchers

The cluster experiment was needed to partly solve sub question five and to assess the two hypotheses constructed in paragraph 2.4.

Sub question five *(i.e. which factors, which determine the success of a virtual community of practice, can be attributed to virtual communities of practice for European research projects?)* was important to ask, additionally to the survey presented in the former paragraph, in order to find out qualitative reasons why some factors are important. This sub question could be specified into the following question:

- *Which factors, which determine the success of a virtual community of practice for European research projects, can be obtained from researchers?*

During making appointments with the participants of the cluster experiment, the questionnaire which was described in the former paragraph was distributed to them as well. The questionnaire provided leads for the cluster experiment. When letting the participant fill in the questionnaire in advance, a significant amount of time could saved. The questionnaire was identical, only the question about adding factors was removed. This was asked for in a qualitative way, in order to get more meaningful answers.

The cluster experiment started by asking which factors the participants rated as 'not important' in the questionnaire, and letting them reason why. This was done, in order to understand more clearly why some factors are perceived as not important. The participants were also asked if they could identify possible factors that would influence the success of a VCoP for European research project. By asking this in a qualitative way, the underlying motivations for those factors could be asked for too.

After the questions were completed it was time to test the hypotheses, which were formulated in paragraph 2.4. The first hypothesis that was assessed is H1:

- *The influence of the factors, which determine the success of virtual communities of practice for European research projects, depends on the size of the community.*

The question that could be derived from this hypothesis was: "*how influential are the factors, which determine the success of virtual communities of practice for European research projects, compared to the size of the community?*" This hypothesis was assessed by letting the participants assign two to three factors, which they perceived to be the most influential on VCoP success, to three different community sizes. The three community sizes are: small (less than ten members); medium (ten to one hundred members); and large (over one hundred members).

The cluster experiment was continued by assessing the second hypothesis, H2:

- *The influence of the factors, which determine the success of virtual communities of practice for European research projects, depends on the phase the community is in.*

The question that could be derived from this hypothesis was: "*how influential are the factors, which determine the success of virtual communities of practice for European research projects, compared to the phase the community is in?*" This hypothesis was assessed by letting the participants assign factors to the five phases described in the VCoP lifecycle (i.e. the beginning phase; the growing phase; the maturing phase; the maintaining phase; and the transformation phase). They needed to assign two to three of the most influential factors per lifecycle phase. This would lead to a better understanding in which phase, which factors are the most influential.

After these assignments, the cluster experiment took place. The factors were printed down on cards (i.e. on 100 milligram paper). Each factor was accompanied by two or three key words that described the factor like in the survey. This was done to make sure that the interpretations of both the researcher and the participants were the same. There was also inserted a blank space. Here, the participant could fill in his or her interpretation if it did not correspond with the interpretation of the researcher. Before the experiment started, the factors that were rated 'not important' were removed. It was perceived by the researcher as not logical to cluster factors that were considered to be not important. In the cluster experiment, participants assigned the factors (i.e. units) which were perceived to be related or correspond to each other, to self-formulated categories (i.e. clusters). In other words, the participants needed to group the factors that they thought that correlated together (Miles & Huberman, 1994). When they completed this task, they had to name the self created clusters.

During the experiment the researcher had the opportunity to ask more deeply about the underlying motivations of the participants when clustering the factors. In this way a more qualitative and complete picture would be the result. The results from this experiment helped setting up the VCoP factor model, which is described in paragraph 5.2.

The cluster experiment design can be found in Appendix IV.II. The cluster experiment was conducted in Dutch, but is presented in English, because that is in line with the language of the overall report.

4.3 Interviews with SCORE! members

Before creating a VCoP for SCORE!, it is fruitful to understand the needs of the community members, and how they perceive the project. Persons are a very important source for information gathering activities. The advantages are that they can process very diverse information and that information can be gathered in fast ways. Also having the possibility to steer persons in directions that are important to the researcher is an important advantage (Verschuren & Doorewaard, 2000). In order to obtain these qualitative insights, it was rewarding to conduct some interviews. The SCORE! members were the source that was needed in this case.

Interviewing is the most used (qualitative) method in social research. Interviews are commonly used for the purpose of getting high-quality and in-depth answers (Dooley, 2001). According to Downs and Adrian (2004), interviews have five advantages. Interviews allow for more detailed and fuller discussions, allow the auditor to become more familiar with the people who are involved, allow for serendipity (i.e. getting unanticipated answers), are a reward to the participant (i.e. people like to talk about things that are important to them), and have an organic nature (i.e. interviews can grow and change when new topics arise). According to Miles and Huberman (1994), interviews also may lead to new hypotheses and questions.

Because not a single method is perfect, the interview has some limitations as well. Interviews are very time-consuming. In most cases this means that they are expensive. Interviews take a lot of time to be carefully coded, analyzed, and interpreted. The third limitation of interviews is that they contain perceptual data (Downs & Adrian, 2004). The structure of the interview is adopted from Downs and Adrian (2004). The research results are tested on objectivity, reliability, and validity from the guidelines of Miles and Huberman (1994, p. 278-279).

4.3.1 Research scheme interviews with SCORE! members

The interviews were needed to partly solve sub question seven *(i.e. which SCORE! specific issues can be identified, that are important when setting up a project specific virtual community of practice?)*. Sub question seven could be specified in the following questions:

- *How satisfied are the SCORE! members with their project!?*
- *What are the needs of the SCORE! members!?*
- *How should the project continue after its official end according to the SCORE! members?*
- *How do SCORE! members perceive the idea when a virtual community of practice will be introduced for their project?*
- *What kind of actions do SCORE! members want to perform in a virtual community of practice, and for what purposes?*
- *Which factors do SCORE! members consider important when working with a virtual community of practice?*
- *What would motivate SCORE! members to participate in a virtual community of practice?*

Qualitative researchers often work with small samples. Random samples can therefore often lead to biased results (Miles and Huberman, 1994). Because the participants that were needed for the interviews only needed to suffice one criteria (i.e. being part of the SCORE! community), random sampling was a good way to select the participants. This meant that participants with different values and perceptions towards SCORE! could be interviewed.

Downs and Adrian (2004) state, that when conducting interviews with people from organizations or communities that consist of more than 50 members, sampling is a good method to select participants. A practical guideline that is often used is to select ten to twenty percent of the total number of people in an organization or community when there are about 150 to 200 employees or members. In the SCORE! community there are at least 130 members involved. According to Downs and Adrian (2004), this would mean that between thirteen and twenty-six people needed to be interviewed, in order to get a representative outcome. However, Miles and Huberman (1994) are stressing that interviews with (too) many participants may lead to complex and cumbersome data. When data needs to be collected from a large group of people, surveys may provide a more adequate way to do it. During the SCORE! workshop, 60 SCORE! members came together. In order to make a compromise between the statements of Downs and Adrian (2004) and Miles and Huberman (1994) and to take the time that was available in account, six to twelve participants were needed for the interviews. In total, eight people could be interviewed.

The interviews were taken during both days of the SCORE! workshop in Paris, France, on the fourth and fifth of June (2007). The interviews were not scheduled in advance, because it was unclear which possible participants were attending which workshops. The researcher did send all workshop attendants an email two weeks in advance of the workshop with the announcement that there is a possibility that they could be approached for an interview. This was done to not scare possible participants away. Not having scheduled the participants in advance meant that the researcher needed to gather the participants during both workshop days. The most convenient time to ask the workshop attendants to participate in an interview was during the breaks.

The interviews were structured of nature, so at least all relevant questions could be asked. The SCORE! members, who were interviewed, are rather busy people from all over Europe who are spending a few days in Paris to attend workshop sessions. This meant that they were not eager to participate in an interview. Besides attending workshops, it was likely to assume that they would rather spend time wandering in Paris, then doing an interview. Therefore, the best option was to make the interview as long as the maximal duration of one workshop session, meaning that the interviews could only last twenty minutes. Conversely, when there were opportunities, the researcher insisted a semi-structured approach. When using a semi-structured approach, the researcher is more open to identify new leads of importance, to extend the area of information, to find more evidence for an important topic, and the like (Miles & Huberman, 1994). The additional questions that came up during the interviews leaded to some additional and fruitful information.

On the first day, the participants of the workshop were rather busy with following the workshop sessions. The researcher made a timetable which fitted exactly in the timeframe of the workshop, but the workshop attendees were not interested to give up a workshop session, in order to do an interview. Because of this, the interviews took place during lunch breaks and after workshop sessions. On the first day this leaded to three conducted interviews and three interview dates for workshop day two.

The second day was even more hectic. There were no interviews planned in the early morning, which gave the researcher the opportunity to ask even more workshop attendees to participate in an interview. In the end it resulted in two more interview participants. Because the workshop sessions were delayed by various reasons, it was hard to coordinate the interviews. The first interview of that day was during the first break. Two other interviews had to be rescheduled. Instead of one interview in the lunch break, there needed to be conducted two. Another interview needed to be rescheduled during a session. The last interview was at the end of workshop day two. Fortunately, the researcher expected this to happen, and made sure he had enough time available between the individual interviews.

The setting of the interview was at the same location as where the workshop was being held. It was important to find an easy accessible, though calm spot where the interviews could be conducted, because it is important that the participants feel at ease, and that they are as less distracted by their surroundings as possible. The interviews during the lunch were conducted at a small dining table at the back of the lunch room, in order to keep away the background noise. The other interviews were held in one of the conference rooms of the hotel that was not in use. The interviews were recorded by using a notebook, a microphone, and Adobe Audition (i.e. a digital audio recording and editing program).

All in all it was a very hectic and energy-consuming experience, but it resulted in data from eight participants, which should be reasonable enough to make some statements. The interview design can be found in Appendix IV.III. Here, also the rationales for the interview questions are presented.

4.4 Survey with SCORE! members

When developing a VCoP for a specific target group, it is important to understand what their profiles are. In chapter three, the profile of the SCORE! community member is given, but the technical issues are not imbedded extensively. Therefore, it was necessary to conduct a survey. It was also fruitful to understand how the community members of SCORE! perceive the idea of introducing a VCoP for their project.

A survey was conducted in order to solve these issues. The survey design used here is also a cross-sectional design. In a cross-sectional design, the survey is only used at one time point to collect data (Dooley, 2001).

4.4.1 Research scheme survey with SCORE! members

The survey was needed, in order to partly solve sub question seven *(i.e. which SCORE! specific issues can be identified, that are important when setting up a project specific virtual community of practice?)*. Sub question seven could be specified in the following questions:

- *How do SCORE! members perceive the idea to introduce a virtual community of practice for their project?*
- *What makes SCORE! members accept and use a virtual community of practice?*
- *What would motivate SCORE! members to participate in a virtual community of practice?*
- *How should SCORE! continue after its official end according to its members?*

The questionnaire contained constructs from the UTAUT model (see section 2.3.4) of Venkatesh et al. (2003). All components of the UTAUT model were integrated in the questionnaire, in order to receive a high internal validity.

Before the questionnaire was printed, it was pre-tested twice. The first pre-test was done with two persons. This was needed to uncover the strengths and weaknesses of the questionnaire. The questionnaire was tested on inconsistencies, the interpretation of the questions, the understanding of the questions, the order of the questions, and the adequateness of the instructions. The pre-test was successful in the way that it leaded to a few, though important improvements. Some questions were articulated in another, better perceivable, way.

The second pre-test was also done with two (other) persons. This pre-test was needed to verify if the questionnaire was without any errors. There were no direct errors, but some other points of improvement were discovered. Some questions displayed some connectivity. This was done on purpose to measure the same construct with several questions. However, because the number of questions was perceived as too large, and because it was perceived as confusing, some questions were deleted. The total number of questions was reduced from forty to thirty-three. One question addressed the importance of tangible compensation. This was perceived to be a confusing entity. Therefore it was rephrased.

The questionnaire was handed out at the SCORE! workshop in Paris. The questionnaire was designed in such a way that it fitted on one A4 sheet. This made it easy for the respondents to fill in the questionnaire. The questionnaires were handed out for several reasons. The first reason was that about fifty percent of all SCORE! members were present at the workshop. By handing out the questionnaire the researcher believed that a great response could be realized. Having a great response would improve the external validity. Random sample error could also be excluded with a great response.

The other reason for handing out the questionnaires was because the other options were less feasible. When questionnaires were sent out in paper form, conducted over the telephone, or conducted face-to-face, it had taken too much time and money. Online questionnaires were also not appropriate, because the respondents (i.e. the SCORE! members) are people with very busy schedules. They receive loads of emails every day, which gives a fair chance that the questionnaire would not be noticed, let alone be filled in.

The workshop sessions were divided in the three consumption domains of SCORE! (see paragraph 3.1). The researcher handed out the questionnaire at each three workshop locations at the starting hour of the second workshop day. The reason for handing out the questionnaire on day two was to not overload the workshop attendants with questions that were irrelevant to the SCORE! workshop. Before handing out the questionnaire, the researcher introduced himself and explained where the questionnaire was about. In the end, eighteen questionnaires were properly filled-in.

The results of this survey are used in chapter six. The survey design can be found in Appendix IV.IV.

4.5 Field test with SCORE! members

In order to get an indication how the SCORE! members work with technology that is new to them, it was interesting to conduct some field tests. A field test is a type of qualitative research. Qualitative research refers in this context to social research based on observations that are analyzed without statistics. Conducting a field test means that one is observing participants in the environment where they normally carry out their activities (Dooley, 2001). Observing tool usage also helps in guiding the design of VCoPs (Schraefel et al., 2000).

There are four consecutive steps in order to conduct a field test (Dooley, 2001). The first step is to gain entry and finding a key informant. This will be not much of a problem, because of the role of the observer in the SCORE! project. The second step is category definition and observation. In this step observers only have general questions as their guide. The observers both observe and choose what to observe during the session. The third step in conducting a field test is data recording. In a physical field study this is either done by audiotape or by handwritten notes. In this case, it was better to use the automatic record functions of the tools. In that way, the researcher could replay the session and observe things that were missed during the first observation. The concluding step is doing the analysis. The discrete observational data should be ordered into conceptual categories (Dooley, 2001).

4.5.1 Research scheme field test with SCORE! members

The field tests were necessary in order to partly solve sub question seven *(i.e. which SCORE! specific issues can be identified, that are important when setting up a project specific virtual community of practice?)*. Sub question seven could be specified in the following questions:

- *How do SCORE! members perceive technology that are new to them?*
- *How much effort does it take for SCORE! members to understand new technology?*
- *How do SCORE! members use new technology?*
- *To what extend can technology create a sense of togetherness?*

The objective preliminary to the field test objectives was identifying possible tools for usage. This was necessary, because there was not a virtual place where SCORE! members could interact with each other. Moreover, there were no proper tools to work with. For this reason sub question six needed to be answered first.

Sub question six *(i.e. which tools can be identified, that can be integrated in a virtual community of practice for European research projects?)* could be specified in the following question:

- *What kind of virtual community of practice tools can be identified that could facilitate members of a European research project?*

This question was solved by reading some articles that related to this question and by searching in media. The media used in this case is the internet. Media were used because they provided good sources to find out more about the latest technologies and tools available. According to Verschuren and Doorewaard (2000), media have a high information density and a high level of actuality. Media are therefore a good source to find fruitful information. There were for example a lot of reviews available on the internet about the different tools, and most tools could be downloaded and tested. An overview of the tools that can be used for VCoPs for European research projects, which also answers the question, can be found in Appendix V.

After the different tools that can be used in VCoPs were identified, it was time to do some testing. The field tests were used to analyse video conferencing tools. This choice was based on the priority of the project managers of SCORE! The other possible tools that would be useful for the SCORE! VCoP are not tested due to time constraints.

In total, three field tests have been conducted. Because the SCORE! members who participated in the field tests had no prior experience with video conferencing, an email was set up and send to them first, in order to give them instructions (i.e. information about the time; the date; the agenda; the requirements to participate; and the steps that need to be conducted before being able to participate in the video conference session). In this way, the participants could be made more comfortable towards video conferencing. The emails were sent one week in advance and a reminder was sent one day before the video conference session. In the emails it was left out that the video conference sessions were also used as a field test. This was done to keep the sessions as neutral as possible. These actions were executed in all three cases. An example of one of those emails can be found in Appendix IV.V.

An adequate way to test the tools could be by using the Adaptive Structuration Theory (see Appendix VI). However, the AST is only useful when testing the same kind of technology in different settings. The goal of the field test is to test how the selected tools work, and if they could be useful for the SCORE! project. The field tests are thus used to test the tools on a more basic level. Because the AST was not useful in this setting, there was made an analysis framework. This framework was used to analyse the effects that were taking place during the field tests. Some constructs of the AST could be integrated in this framework though. The technology was assessed on its usability, sociability, and other related issues. The analysis framework can be found in Appendix IV.V.

All three field tests had different objectives. The first field test assessed FlashMeeting (see appendix section V.I.III). The objective of the first field test was to get affinity with video conferencing. The first field test can be described as a test case. This test was important for the researcher, in order to adjust the analysis framework. It was also important for the project managers of SCORE! who will need to conduct more of these sessions in the future. This field test was conducted with five participants form two European countries and lasted one hour.

In the second field test, the session became more real. The objective of the second field tests was for the co-ordination team of SCORE! to plan activities for the workshop in Paris. This could however not be done in a physical setting, so it was an excellent case to test another video conferencing tool. The tool used in this field test was WebEx (see Appendix section V.I.III). WebEx was chosen, because an additional requirement was that the tool could present documents, which was not possible with FlashMeeting. This field test was conducted with six participants form four European countries and lasted one hour and forty-five minutes.

The third field test was also a real session. In this video conference session there needed to be made decisions on how to organize the spin-off for SCORE! In this field test there was made use of FlashMeeting, because it was only necessary to discuss. The field test was conducted with seven participants from five European countries and one from United States. The meeting lasted one hour and a half. The results of the field tests are used in chapter six.

5 VCOP PROCESS MODEL & FACTOR MODEL

Coming together is the beginning - keeping together is progress - working together is success (Henry Ford)

In this chapter, the VCoP process model and the VCoP factor model are described. The process model is addressed first. The VCoP process model makes clear which steps need to be conducted, in order to set up a VCoP for European research projects. In the second paragraph of this chapter, the VCoP factor model is highlighted. The VCoP factor model makes clear which factors are important in VCoPs for European research projects.

5.1 Research results: setting up the VCoP process model

In this paragraph, the steps and phases of the VCoP process model are articulated and carefully described. Per phase and stage, the factors that are important are included. These factors are not included in the process model itself, because it would make the process model inconvenient to read.

Setting up the VCoP process model is done by combining the results from various studies into one model. Results from three studies (i.e. Allen et al., 2003; Saint-Onge & Wallace, 2003; and Preece, 2000) are combined with the VCoP lifecycle from Wenger et al. (2002a), with the star life cycle from Hix and Hartson (1993), which is described in the next section, and with the results from own research (e.g. quotes from participants of the cluster experiment and the SCORE! interview). The primary goal of the VCoP process model is to make clear which steps need to be conducted from the beginning when the idea is formed to initiate a VCoP, to the moment when the VCoP is actually launched. Also the factors that need to be taken in account during those phases and stages belong to this goal. The secondary goal of the model is to give an indication how a VCoP can evolve.

It would be worthwhile to develop a process model which could be applied to all kinds of VCoPs. Because all VCoPs have unique characteristics, it is very difficult to do so (Saint-Onge & Wallace, 2003). For this reason, a process model is created specifically for VCoPs for European research projects. The VCoP process model functions as a framework to set up such VCoP in a successful way. This framework needs to be used as an extensive guide that identifies necessary requirements. It is important to develop such a model, because currently there are no such models. The VCoP process model is presented on the next page (see figure 5.1). In the following section, the VCoP process model is carefully explained.

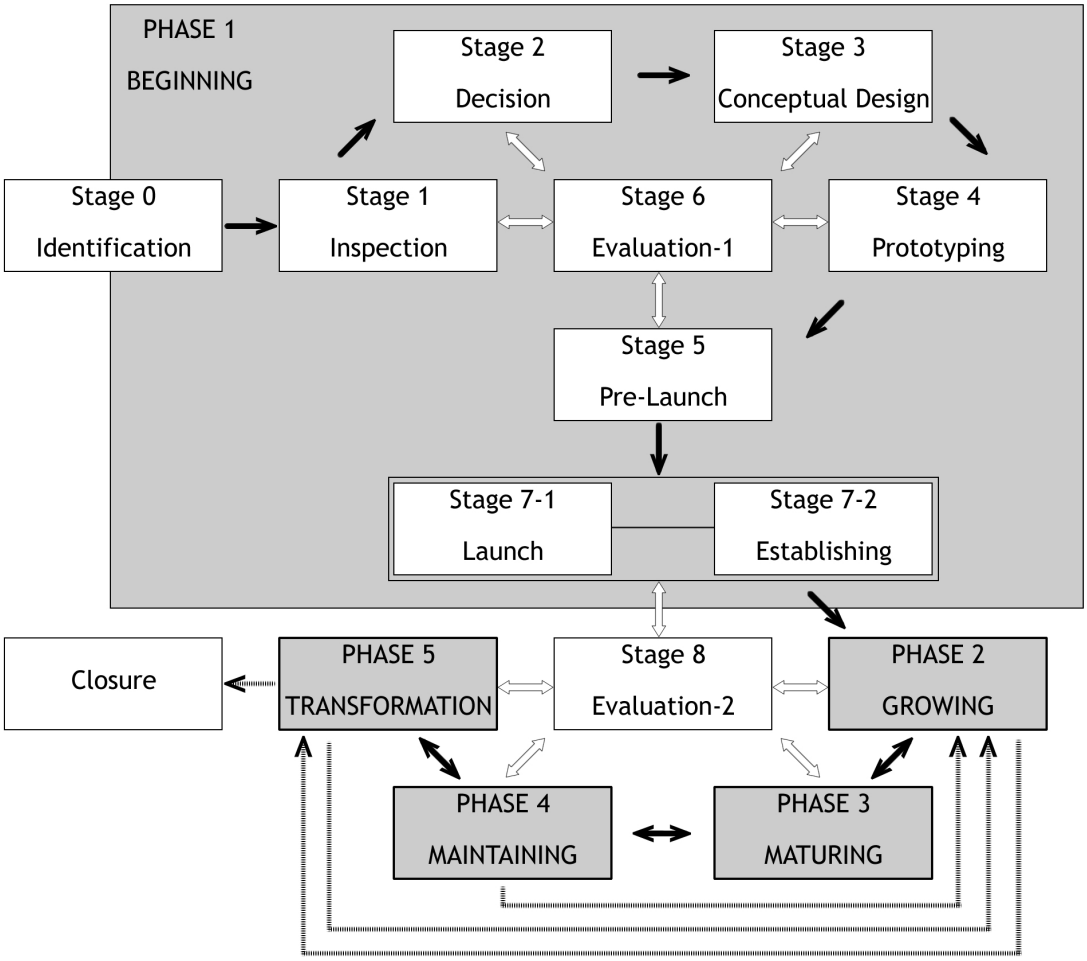

Figure 5.1: The VCoP process model

5.1.1 The steps of the VCoP process model

In this section, the description of the VCoP process model is presented. The different phases and the steps that need to be taken to set up the VCoP are highlighted. The steps are called stages in the VCoP process model, because each stage consists of different steps (i.e. actions). Each stage is supported by a table in which the different actions are described. In total, nine stages could be identified. These stages are: the identification stage; the inspection stage; the decision stage; the conceptual design stage; the prototyping stage; the pre-launch stage; the formative evaluation stage; the launch and establishment stage; and the summative evaluation stage.

- **Phase 1: the beginning phase**
  Phase one is always the start in the process of creating a VCoP. This phase is renamed (i.e. Wenger et al. (2002a) call it 'potential'), because this name has more meaning towards VCoPs for European research projects. Moreover, the researcher considers potential as a part of the beginning phase.

  In this phase, the research partners form the idea to initiate a VCoP for their European research project. This is also the phase in which the VCoP is constructed. The following stages explain what needs to be done, and what needs to be taken in account, during the first phase.

- **Stage 0: the identification stage.**
  From the VCoP lifecycle it can be distilled that the most important thing in this stage is that people need to find each other and identify the potential to form a community. In European research projects this works a little different than how spontaneous VCoPs arise. Before a European research project starts, someone writes a proposal first. When this proposal is accepted, the person who has obtained the project is trying to find some interesting project partners to work with. Because these are things that have nothing to do with the forming of a VCoP, this stage lies partly out of phase one. When the project partners are identified, the community is basically formed.

  When the community of research partners is gathered, the idea needs to arise to set up a VCoP for the research project. The idea needs to be approved by the community, in order to make it more concrete and to get support from the community when the VCoP is ready to use. This part lies within the first phase. However, it is advisable that the community first comes together in real-life before starting a VCoP. This is necessary to form relationships and to create trust in the community, which leads to fruitful collaboration in the future. One participant stated the following:

  "Personal contact can not be replaced – relationships need to be established first"

Stage	Actions
Stage 0: the identification stage	❖ Obtain a research project ❖ Identify research partners ❖ Identify the need to form a VCoP

Table 5.1: Actions of stage 0

- **Stage 1: the inspection stage**
  When the idea is formed to create a VCoP, it is time to enter the inspection stage. In this stage, an important role lies in the hands of the steering committee (i.e. the project partners who take care of the VCoP development process). The steering committee, which might presumably be the project managers of the research project, needs to take an active role in this stage. They are the ones that need to form the VCoP. According to Saint-Onge and Wallace (2003) at least one to two hours a week are needed to work out the VCoP idea.

  The most important thing to do in this stage is to make the goals, purpose, and needs of the VCoP clear. An example can be having a goal to share technical expertise, which leads to innovation strategies. When community members see the value and relevance of the VCoP they are more likely to use the VCoP. This needs to be carefully outlined by the steering committee. Some quotes by participants to address this statement:

  "The VCoP should only focus on project related tasks"

  "Needs and goals are important to go and participate in a VCoP"

  "Once the goal is set, you can be more creative of thinking"

  If a VCoP is not immediately introduced when the research project starts, but after some time, it is important to adjust the goals of the VCoP towards the current goals of the research project. This makes VCoP participation meaningful. Furthermore, it is important to make clear what the goals, purpose, and needs of the VCoP are in the long-term (e.g. when the research project is finished). This is also attributed by one of the participants. According to this participant, the steering committee needs to ask itself the following question during this early stage:

  "What will the VCoP look like in the future?"

It is not only important to identify the purpose, goals, and needs of the VCoP, but the VCoP concept itself also needs to be clearly communicated to the community. This needs to be done in a project specific way, because it makes it more intelligible to the community to understand where they need to work on (Saint-Onge & Wallace, 2003). In other words, participation should be relevant. When communicating to the community, it is important to focus the contents of the message to the whole community, rather than on the individual level (Saint-Onge & Wallace, 2003).

According to Saint-Onge and Wallace (2003), the steering committee often hires a project manager that leads the development process in a clear and efficient way. The project manager sets up a project plan. In the project plan several things are described. First of all, the purpose and goals need to be included. Besides this, the needs of the community members, governance components (e.g. netiquette) (Saint-Onge & Wallace, 2003), project schedules, graphical, functional, and technical designs, budgets, opportunities and threats, and contracts, are often included in a project plan as well.

In this stage, it is furthermore important to identify the requirements for the VCoP. This is often done by the people who actually design the VCoP (i.e. the developer). Requirements can, according to Stone et al. (2005), be gathered by using various techniques (e.g. observations; interviews; and surveys). It is important to understand the needs, expectations, motivations, and attitudes of community members towards VCoP usage. Often a task analysis is conducted to discover the requirements. In a task analysis, the developer tries to understand what the VCoP must be able to do and the functionality it must provide to support the users in their goals and tasks (Stone et al., 2005). Two techniques that are often used in task analysis are: what has to be done; and how it is done. According to Stone et al. (2005), it is unpractical to study every task. Therefore it is at least essential to focus on the most important tasks.

Allen et al. (2003) and Saint-Onge and Wallace (2003) suggest some questions that need to be asked in this stage. A few examples of these questions are: what is the community trying to do and what will be its value; why does the VCoP needs to be developed; what are the benefits; and what kind of role does the steering committee take? Two useful additions were made by participants:

"When do people feel the need to visit?"

"What has to come out of it?"

Although VCoPs might have benefits for research projects, not everyone in the community might be able to see those benefits. Good communication and a well understanding of what needs to be achieved with the VCoP are essential. As one participant stated:

"It is kind of a gamble, but it could work – risk a failure"

Stage	Actions
Stage 1: the inspection stage	❖ Make clear what the goals, purpose, and needs of the VCoP are in the short-term ❖ Make clear what the future goals, purpose, and needs of the VCoP are in the long-term ❖ Communicate the VCoP concept in a research project specific way ❖ Construct a project plan ❖ Conduct an inspection of the requirements ❖ Communicate the benefits

Table 5.2: Actions of stage 1

- **Stage 2: the decision stage**
  When the issues of step one are well thought of and well articulated, it is time to go to stage two. The decision stage deals with two issues. The first issue treats how the VCoP is organized, and the second issue considers the tools that can be integrated.

  Issue 1: Usually CoPs are formed with a bottom-up approach. However, this is not possible with a VCoP for European research projects, at least not in the beginning. Many participants indicate that it is important to run the VCoP from a top-down approach. One participant mentioned that because of the business interest in European research projects, VCoPs can not be designed bottom-up. Furthermore, this participant articulates:

  "The top needs to have strong walls –
  the top needs to make clear who and what can and can not be done within the VCoP"

  Protocols and norms, what Preece (2001) describes as 'netiquette' are essential for a VCoP. A netiquette includes the guidelines how to participate in the VCoP. The contents of a netiquette can differ per research community. Often, things like how to react on discussions, or how to upload files into the library, are included in a netiquette. A-synchronous discussions for example, need to have clear and specific goals. Participants addressed that they do not use discussion forums, because of not seeing the purpose or value of it. When discussion topics are articulated clearly, this problem can be reduced. To take the uploading example; when there are no rules, the library can become a junkyard of information (McDermott, 2000). It is also important to include legal issues (e.g. copyrights) in the netiquette. Normally a netiquette is formed interactively in a VCoP, but in a VCoP for European research projects, it is better to start off with some pre-defined rules.

  Another important legal issue, which does not belong in the netiquette, is to whom the received knowledge in the VCoP belongs. VCoPs rely on free transfer of information and knowledge. In order to do so, it must be viewed as a public good (Ardichvili et al., 2003). Conversely, knowledge is often considered a private good (Wasko & Faraj, 2000). If this is a harsh point to consider, the steering committee must make sure that there are contracts which explain clearly who owns the contents within the VCoP.

  In stage one, it is made clear what needs to be done in a VCoP. This means that there should also be decided on who does what in the VCoP. It is important for community members that there is a division of tasks. More information about the roles members can take in a VCoP can be found in Appendix VII.

  Two of the most important roles are described in this section. First of all, it is important to recruit a facilitator. This person should plan the activities in, and around the VCoP, should promote the VCoP to the community members of the research project, and should coach community members who have questions (Saint-Onge & Wallace). According to them, it is preferred that the facilitator is someone from the community. The facilitator role could be described as the spokesperson of the VCoP. Without a facilitator the VCoP might still succeed, but successes are gained in slower ways.

  Besides a facilitator, it is also important to employ a moderator (i.e. the community administrator). According to Saint-Onge and Wallace (2003), this person helps when community members have problems with tools used in the VCoP, when members want to register, etcetera. Based on their experience, Saint-Onge and Wallace (2003) state that a moderator spends about one to two hours a week in the phases before the VCoP is developed, and about one hour a week after the VCoP is launched. However, when the VCoP is becoming larger and is used more often, it can be presumed that the moderator has a full-time job in this. The moderator is often someone outside the community, with much technical expertise.

Another important decision deals with membership criteria. It is wise to decide if the VCoP is available for a selected group of members, for all members, or for all internet users (i.e. open versus closed membership). In most cases 'rights' are allocated. This means that some information is only visible for certain kind of members. This is essential when confidential information is presented on the VCoP.

An additional decision to make is if their needs to be paid a membership fee, or not. Funds are essential for a VCoP to stay operative, but if funds are received by membership fees, some members might see this as a barrier. Moreover, the internet user of today does not want to pay for content anymore. Paid memberships are not so much of an issue during the research project, but could be when the research project is finished.

When having decided this, the registering process itself needs to be considered as well. Registering provides several barriers that need to be taken in account. People have to fill in their personal information, which results in privacy barriers. Furthermore, when people need to register, they need a password to enter the VCoP, which might cause uncertainty.

The last thing that needs to be decided, considering the first issue, is how the purposes and goals, described in stage one, are going to be measured. If this is not made clear, it is impossible to measure if the VCoP is successful or not. As noted by Allen et al. (2003), VCoPs are often being evaluated on the basis of (quantitative) metrics. They also mention that different metrics are often combined, in order to get more significant data about the VCoP. It is furthermore advised by them to use qualitative measurements. Qualitative data gives more meaning to the numbers obtained from the quantitative metrics. Qualitative data is often gathered from success stories, or stories about VCoPs that have failed. Most VCoPs are different from each other, meaning that some metrics for one VCoP can mean nothing to another one. For this reason, a VCoP should be evaluated on its original purpose and goals.

Issue 2: Now it is time to describe the second issue of the decision stage. This issue is usually taken care of by the developer. The developer often works under the supervision of the steering committee. After the requirements have been made clear in stage one, it can be decided what kind of technology needs to selected for the VCoP. The tools should be selected according to the needs of the community members. This means that community members should be able to realise their purposes and goals with the provided tools (Allen et al., 2003). As one participant stated:

"When the VCoP is for architects it needs to provide drawing programs"

Also the structure of the VCoP needs to be made clear in this stage. The structure should be user friendly. This criterion was often mentioned by the participants. If the technology is too difficult, community members will not use them, because they already have to work in a different setting than they are used to. Deciding on the tools and the structure are two important issues to think about, because VCoPs depend very much on technology (Allen et al., 2003). Because the goals of the VCoP might change during the research project itself, and after the end of the project, it is plausible that different tools need to be used as well. It is therefore important to set up the VCoP in such a way that it is easy modifiable. Wenger et al. (2002b) define this as 'design for evolution'. Also when the community starts to grow rapidly, the technology should be able to handle it (Allen et al., 2003). One participant contributed the following to the user friendliness of VCoPs:

"The users do not want to understand how things are done - they only care about doing the things they want to do - speed, effort, and easiness of use are important motivations"

According to Saint-Onge and Wallace (2003), technology used in a VCoP should meet four criteria. The tools should be able to facilitate rich conversations, should encourage participation (e.g. ease of use; feedback mechanisms; and convenient access), should support knowledge access (e.g. search engines), and should have a flexible structure (e.g. self-organizing, secure and open areas; and a low administrative burden). They also provide some general questions to ask when choosing technology (e.g. which technology can support the VCoP; what is currently in place; and how technology will be introduced to the community members?). They furthermore state that the focus should be on what is needed, and not on what might be needed. It is therefore crucial to seek a good balance between what to provide and what not.

Technology that is at least needed in a VCoP is conversation tools. According to Wenger et al. (2005), many communities start off as conversation groups. This is in line with Saint-Onge and Wallace (2003). It is therefore important to implement conversation tools in a VCoP. Wenger et al. (2005) also make clear what kinds of facilities are often integrated in VCoPs. These facilities are described as follows: a home page with information about the domain; a shared workspace; a document repository; a search engine; community management tools; and tools to create sub communities. Although these tools are frequently used in VCoPs, it does not mean that they are all needed. It really depends on the goals and purpose of the specific VCoP.

Many open source tools can be integrated in a VCoP, which can be of great importance when considering budgets. Although the costs of these tools are nil, often much expertise is needed to install them, and to make them actually work (Wenger et al., 2005). Therefore, open source tools are not always feasible to use.

One participant mentioned that firewalls caused some technology to fail. It is therefore important to take possible firewall flaws in mind as well. Wenger et al. (2005) mention five complementary issues which should be taken in account when choosing technology. These issues are: the region of the community members (e.g. different time-zones and the level of physical meetings); the kind of internet access (e.g. when community members have slow internet connections, demanding programs can not be properly used); the skills of the community members (e.g. are the community members comfortable with technology); the necessity of forming sub-communities during the project (e.g. personalized workspaces are needed then); and understanding what kind of material will be shared between the community members (e.g. small documents versus large 3D files).

According to Wenger et al. (2005) the perfect product for a general VCoP does not exist. It can be concluded that the perfect product for a VCoP for European research project does not exist either. This means that there needs to be created one. Because of the differences between research communities, the VCoP process model does not provide a guide to specifically outline the tools that need to be used. The tools that can be chosen to use in a VCoP are described in Appendix V. Nevertheless, an example of tool selection is presented within chapter six.

Wenger et al. (2005) furthermore state that technology itself will not make a VCoP successful. However, technology can ruin the VCoP when it is used in a bad manner. Saint-Onge and Wallace (2003) complement this by stating that technology is the enabler of VCoP development, not the focus.

A final important point to consider in this stage is that the VCoP should not be overloaded with all kinds of functionality. Rather, VCoP tools need to be integrated when community members feel and address a need for it. It is important to not push the community members with technology.

Stage	Actions
Stage 2: the decision stage	Issue 1: ❖ Deciding how to organize the VCoP (preferably top-down) ❖ Setting up a netiquette (decide on the rules of engagement of the VCoP) ❖ Decide to whom the knowledge and information in the VCoP belongs to (construct a contract) ❖ Deciding on member roles ❖ Decide who the VCoP facilitator is going to be ❖ Install a VCoP moderator ❖ Decide on membership criteria (and fees) ❖ Decide how to measure success Issue 2: ❖ Decide which technological structure, and corresponding tools should be used in the VCoP

Table 5.3: Actions of stage 2

- **Stage 3: the conceptual design stage**

  When the issues of stage two are solved and there is still enough support to continue with the development of a VCoP, it is time to take the ideas to the drawing board. When starting with the conceptual design stage, it is essential to have profiles of the users for which the VCoP is going to be designed. User profiles contain basic information (e.g. age; sex; and computer experience) about the users. User profiles could also be gathered during the requirement gathering process described in stage one.

  When developing a VCoP, it can best be done by using a user-centered design approach. A user-centered design approach involves community members in the design and development processes of the VCoP. When using such an approach, the users and the tasks that they will perform are understood more clearly. There are four main principles to a user-centered design approach. These principles are: active involvement of the user; appropriate allocation between the user and the system; iteration of design solutions; and multidisciplinary design teams (Stone et al., 2005). It is important to use this kind of design, in order to optimize the usability of the VCoP.

  A good way to do develop an application is by using the star life cycle from Hix and Hartson (1993; cited by Stone et al., 2005). The star life cycle (see figure 5.2) encourages iteration and makes clear that evaluation is relevant at all stages. The users of the VCoP should be involved at all stages of the VCoP development process (Stone et al., 2005). The star life cycle is already integrated in this VCoP process model. When designing a VCoP, the developers need to follow some design guidelines as well. These design guidelines can be found in Appendix I. Guidelines are important to make work easier for both the developer, and the users of the VCoP.

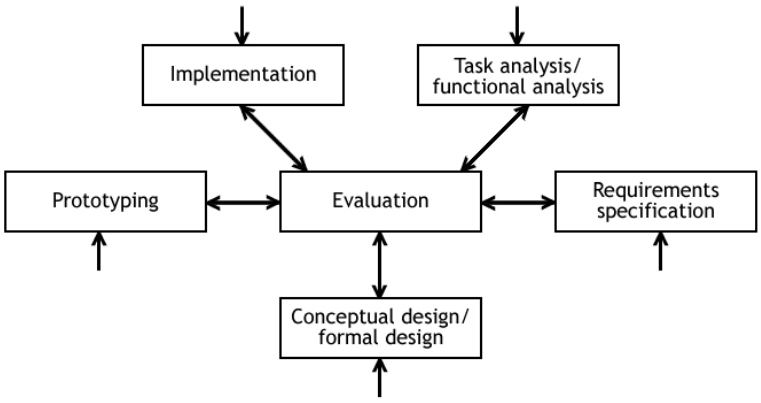

Figure 5.2: The star life cycle (Hix & Hartson, 1993; adopted from Stone et al., 2005)

In this stage, it is important to keep records of the changes and decisions that are made. Three reasons of record keeping are identified by Stone et al. (2005). Decisions may need to be reconsidered. When they are not written down, they might be forgotten. When people leave the project, it is still possible to find the reasons for the decisions that have been made. The last reason is that it saves development effort when a similar VCoP is reused or set up in another project.

The conceptual design stage is like the prototyping stage (see stage four). However, conceptual design is done on a more basic level. A prototype is an experimental design which is used to test several design ideas. Prototyping can be done in different ways. One type of prototyping is low-fidelity prototyping. This type is concentrating on the structure and appearance of the VCoP. It often includes paper sketches and/or mock-ups (Stone et al., 2005). Conceptual design can be translated in low-fidelity prototyping. With low-fidelity prototyping the basic ideas of how the VCoP will look like are tested. In this stage, the VCoP can be easily modified without great costs.

Stage	Actions
Stage 3: the conceptual design stage	❖ Create user profiles ❖ Take a user-centered design perspective ❖ Low-fidelity prototyping ❖ Keep records of decisions made during the conceptual design process

Table 5.4: Actions of stage 3

- **Stage 4: the prototyping stage**

In the third stage low-fidelity prototyping is used. When the conceptual design is approved, it is time to go to the fourth stage. In this stage the high-fidelity prototyping approach is taken. This type of prototyping goes further, and gives the users a look-and-feel of the application in development. In this stage, the VCoP structure is established. Also the tools that are going to be used are integrated in this stage.

High-fidelity prototyping stands close to the final product (Stone et al., 2005). Besides that, high-fidelity prototyping is a good way to find out if the VCoP is working well. Stone et al. (2005) describe six purposes why prototyping is useful. These purposes are: check feasibility with the users; check the usefulness of the application; allow users to contribute; allow users to test ideas; validate requirements; and negotiate requirements.

During the high-fidelity prototype stage, there are probably some constraints and trade-offs that need to be made. These constraints and trade-offs often have to do with costs, budgets, timescales, the technology that is available, the agenda of individual stakeholders, contradictory requirements, and organizational policies. The constraints and trade-offs should be evaluated in terms of how it would impact community members in VCoP usage (Stone et al., 2005). In this stage, it is important to keep records of the changes and decisions that are made as well.

Stage	Actions
Stage 4: the prototyping stage	❖ Establish technological structure ❖ High-fidelity prototyping ❖ Keep records of decisions made during the prototyping process

Table 5.5: Actions of stage 4

- **Stage 5: the pre-launch stage**

  When the prototype is tested on basic level, it needs to be tested in a real setting. Because there can be a lot at stake when initiating a VCoP, it is recommended to first launch the VCoP with a selected group of motivated community members. These members must be willing to work (and cooperate) in the VCoP. This 'core-group' should take responsibility during and after the launch phase to pull the rest of the community. They should lead and organize the VCoP (together with the steering committee). This is also attributed by a participant:

  "There needs to be a small group that takes responsibility for the community"

  By first pre-launching the VCoP, it can be carefully examined if it is working well and if it fits the requirements. This stage can be seen as a highly advanced prototyping stage. When there are problems, the developer is still able to make adjustments, while preventing too much negativity from the community. A best practice of Saint-Onge and Wallace (2003) is to invite more people in the pre-launch stage to become a member than is wished for, because some people might not be interested. This is also endorsed by two participants. They would not like to be part of try-out stages, because:

  "I am a researcher, not a developer"

  "This is not what researchers are supposed to do"

  Allen et al. (2003) provide a useful comment that information put in the VCoP at this stage should not be lost when entering the launch stage. Moreover, when launching the VCoP it is not completely empty, which may give the other community members energy to explore and start using the VCoP.

Stage	Actions
Stage 5: the pre-launch stage	❖ Identify a core-group ❖ Let the core-group test the VCoP by letting them do realistic tasks

Table 5.6: Actions of stage 5

- **Stage 6: evaluation stage one - formative evaluation**

  Evaluation is a way of finding out if things work. It is a method to understand problems and to solve them. Evaluation stage one takes place after stages one to five. Because the process of developing a VCoP should be done in an iterative way, the users of the VCoP should be constantly involved in the different processes. When a stage is completed, it first goes to the evaluation stage before it enters the next stage. When problems are found, it is advised to return to the current stage and to solve them. If it is necessary, it could be evaluated again. When there are no more problems left, it is time to enter the next stage. Stage six is called 'formative evaluation', because these evaluations take place before the VCoP is launched. Formative evaluation is often conducted in early stages of development. It is used to find as many possibilities to improve the VCoP as possible (Stone et al., 2005).

Stage	Actions
Stage 6: evaluation stage one: formative evaluation	❖ Evaluate all stages before going to the next ❖ Discover errors (or other flaws) ❖ Make adjustments to resolve errors

Table 5.7: Actions of stage 6

- **Stage 7-1: the launch stage**
  When all the preparations are successfully finished, it is time to launch the VCoP for all community members. In this stage, the VCoP is basically made accessible to all community members of the research project. The establishment stage immediately follows after, or is initiated just before the launch stage. This stage can be seen as 'the moment of truth', and is described next. Because these two stages are narrowly related they can be taken together as one stage.

Stage	Actions
Stage 7-1: the launch stage	❖ Present the VCoP to all community members

Table 5.8: Actions of stage 7-1

- **Stage 7-2: the establishment stage**
  Saint-Onge and Wallace (2003) make clear that the steering committee needs to provide the content and guidance for launching the VCoP. This stage consists out of many important actions that need to be executed. First of all, community members need to be welcomed, nurtured, and educated (Allen et al., 2003). Secondly, memberships should be established. Although community building has started by physical meetings, it should now take place in a virtual way as well.

  According to Saint-Onge and Wallace (2003), and to some participants, moderators play an important role in this stage. The community members need to have good access to (technical) support if it is necessary. One participant mentioned that support is essential when working in a technical environment like a VCoP. This is especially necessary in the beginning. When community members do not understand properly how to use the technology, they become frustrated and will not use it again. That is the reason why training is essential. This conclusion is based on the experiences and results from the field tests. Learning to use technology is done by actually using it. Training can also motivate community members, because all kinds of possibilities are demonstrated. However, they are only motivated as long as it has added value. Two contributions by participants:

  "Technology works well, but only after a habituation period"

  "When technology does not work properly, people will quit"

  When wanting to make the VCoP a success, it is preferred that most community members contribute to it regularly. Besides articulating this at physical meetings, it is also advisable to conduct online meetings on a regular basis. Pushing community members to organize discussions about their topic of interest keeps them motivated, and makes the VCoP interesting to use. When making the community member part of the whole, a positive atmosphere can be created.

  After the launch, the facilitator, but also the core-group, needs to guide the community at least for the first four months. This will take them approximately one hour a week (Saint-Onge & Wallace, 2003).

  The netiquette also needs to be communicated clearly. Community members should use the VCoP in the way as it is described in order to keep the VCoP clean and pure.

Stage	Actions
Stage 7-2: the establishment stage	❖ Welcome, nurture, and educate community members ❖ Establish memberships ❖ Start community building ❖ The facilitator and the core-group should lead the other community members ❖ The moderator should provide community members with technical support ❖ Conduct regular online (and offline) meetings ❖ Communicate the netiquette

Table 5.9: Actions of stage 7-2

- **Stage 8: evaluation stage two - summative evaluation**
  Evaluation stage two takes place after phase one, and during the other four phases. When the VCoP is launched, it is important to test the VCoP on a continuous basis. To make a potential successful VCoP really successful, it is necessary to track down the interactions in the VCoP. The VCoP needs to be constantly controlled. The evaluations are based on the criteria formulated in stage two. This stage is called 'summative evaluation', because evaluation takes place after the VCoP has been launched.

  In stage two, the criteria how to evaluate the success of the VCoP are decided for. In this stage, the measures take place. The steering committee should be monitoring what is happening within the VCoP and, if necessary, adjust its course. As noted by Allen et al. (2003) the measures can be both qualitative and quantitative. Moreover, Saint-Onge and Wallace (2003) state that VCoP success is not measured by milestones from the project plan, but by community members who see value from their participation in the VCoP. They have made a small overview of the kind of things that need to be asked for in a quantitative study. According to them it is important to identify the return rates, the user profiles, the user experiences (e.g. the intelligibility of the purposes and objectives; user friendliness; and if it is up-to-date enough), the sections that are most used and why, the value (i.e. opportunities) that community members see in the VCoP, the limitations of the VCoP, the motivations to continue working with the VCoP, and the motivations of people who do not use the VCoP. Preece (2001) complements the user experience evaluation of Saint-Onge and Wallace (2003) by speed of learning, productivity, satisfaction, retention, and errors.

  It is also wishful to integrate user statistics. This includes how many members have visited the VCoP, for how long, and what they have downloaded and used, etcetera. This provides useful insights in how the VCoP is functioning. In order to gain a more complete picture of the VCoP, it is furthermore important to use qualitative measurements. The qualitative data can give meaning to the numbers obtained from the quantitative metrics. Qualitative data is most of the time gathered from success stories, or stories about communities that failed (Allen et al., 2003).

  When conducting evaluations, it is important to acknowledge both positive and negative comments made by community members. Negative results can be used as learning experiences, which, according to Saint-Onge and Wallace (2003), can strengthen the sense of community. Moreover, it is wise to communicate the results back to them. Besides communicating the research results, it is furthermore important to communicate project successes that are achieved within the VCoP (Saint-Onge & Wallace, 2003). It is also important to test the tools on a regular basis if they are adequately used, and if they (still) meet the needs of the community members.

Stage	Actions
Stage 8: evaluation stage two: summative evaluation	❖ Evaluate the VCoP on a continues basis ❖ Communicate evaluation results to the community (both positive and negative) ❖ Communicate VCoP successes

Table 5.10: Actions of stage 8

- **Phase 2: the growing phase**
  This phase follows immediately after the first phase is completed (i.e. when the VCoP has been launched). In this phase, community members start participating in the VCoP. This phase is renamed (i.e. Wenger et al. (2002a) call it 'coalescing'), because this name has more meaning towards VCoPs for European research projects. It is important to get a critical mass of community members who are willing to participate in the VCoP. When interesting people, next to the current community members, are needed, it is fruitful to do some advertising. However, only people who can contribute to the overall goals of the VCoP should be invited. This can for example be done be advertising in a specialist magazine. Although a smaller audience is reached, compared with advertising in popular magazines, at least the right target group is approached. Reaching the right target group is essential in research projects. Mouth-to-mouth advertisement is also important. This form of free advertising can lead many people to the VCoP.

  There are more challenges that need to be taken into account when growing the VCoP. These challenges are: how to stimulate community members to participate, contribute, and cooperate; how knowledge creation can be enhanced; and how to keep the focus of the VCoP clear without losing the informal character of a VCoP.

  Approaching members to participate is essential. This can be done during physical meetings. Besides constantly communicating to participate, there might also be possibilities to force them indirectly. This needs to be taken care of in stage one. When the goals are articulated in such a way that the VCoP is necessary to use in the research project, people will use it. When VCoP usage is not an integral part of the project, there might be a number of research partners that will not participate in the VCoP. Using direct force, in order to let community members participate in a VCoP, will however not work. This is because participation in a VCoP is voluntary.

  One participant claimed that this phase can be seen as a 'go, no go' phase. When things do not work at all in the VCoP, there are no possibilities to enter phase three. This means that phase five is entered, and that the VCoP probably ceases to exist.

- **Phase 3: the maturing phase**
  A lot of activities are going on in this phase. The community members engage in joint activities and set the standards, and the VCoP begins to clarify its focus, role, and boundaries (Wenger et al., 2002a). This phase is the most interesting phase for community members to be in. Also a critical mass, which posts on a frequent basis, and which make this all happen is necessary. However, the VCoP should be functioning around its original purposes. One participant addressed:

  "When acting around the main goal,
  the members get what they want and what they expected"

  The steering committee or core-group that pulls the community should loosen their strings in this phase. The steering committee should continue monitoring the overall process though. Monitoring is especially important when still being in the research project. When the project ends, it would be wonderful if the bottom itself would make the VCoP stay alive. That should be the ultimate goal. In this case the VCoP is organized bottom-up, instead of top-down.

The final issue to consider in this stage is that it is necessary to re-evaluate the goals when the research project ends. The steering committee needs to ask itself what will happen when people leave, how to attract new people, and what the VCoP will look like in the future. The steering committee needs to decide to keep the VCoP alive (e.g. giving it a new impulse by starting a new project or leaving it as it is), to close the VCoP down, or to hand it over to others. Besides the steering committee, also other motivated community members (e.g. the core-group) should think about this. When VCoP usage is continued, it is important to consider how to get funds, because funding stops after the end of the research project. Funds are needed, because management of the VCoP is still very important, and management needs money in order to do its job.

- **Phase 4: the maintaining phase**

  This phase is seen by many participants as the phase after the research project has ended. For that reason this phase is renamed (i.e. Wenger et al. (2002a) call it 'stewardship'). This is the phase where according to one participant 'the boys get separated from the men'.

  Continuing with a VCoP when the project is finished depends on the results achieved during the project and on the goals for the second beginning. Some research projects work towards an end product. In those projects it might be difficult to continue. When research projects have other goals like developing standards, or to put some issues on the political agenda, continuing might be profitable. Standards need to be modified when new developments take place and ask for it. When a research project wants to achieve recognition for the topic that they have started, it would be a waste to end with it after the project. When enough motivation is gathered to continue, it could work to maintain it. In order to maintain it, the goals must be clear. In this way experiences are preserved and the project can be extended. However, this is not feasible in all projects. Some institutes are purely sustaining on the experience of their employees, rather than on the experiences gained in a project. Besides this, another downside emerges when others are joining the VCoP. As said by a participant:

  "There might be learned over a hundred lessons in a project, but when someone does not understand the background of the project, only fifteen lessons may be extracted"

  It is important in this phase that the activities in the VCoP are still in line with the goals from the beginning, or with the goals that are articulated just before the research project officially would come to an end. According to a participant:

  "Practices still need to be related to the overall goal of the VCoP"

  The (new) goals are new incentives which make people get motivated (again) to stay or start participating in the VCoP. The goals can be to expend it with other projects, to end with a final product and a small group that keeps it up-to-date, or to maintain it because of the community and leaving it as it is. In this stage, it is also important to attract new members, or at least starting to attract them. This can be done by keeping the level of actuality high. Stimulating articles, news letters, or physical meetings make people aware of the VCoP, which may result in people coming (back) to the VCoP. When people get excited again to participate in the VCoP, the VCoP could go back to phase two or three.

  It might also be fruitful to change from a research approach perspective to a topic perspective. When the focus is on topics and themes, the content becomes important again. This might provide community members with new energy.

- **Phase 5: the transformation phase**
  This phase is the result of what is done in previous phases. Loosing community members can not be avoided, 'but new people can be attracted'. The VCoP could be kept alive by new (propositions of) projects or products. If the VCoP needs to continue, the enthusiastic community members that are still there, or just joined in, should take action. In a positive scenario, the VCoP can return to phase two. In a worst case scenario, the VCoP will cease to exist. Constant evaluation is needed to adjust the VCoP towards the needs of the community members. This is necessary in this phase as well.

5.1.2 Important factors per community phase

This section presents the factors that are important in a VCoP for European research projects, per VCoP phase. These factors are the result of the cluster experiment, and are presented in the underlying table (see table 5.11).

Phase	Factors
1. Beginning phase	Characteristics of the VCoP Relevance Responsible members
2. Growing phase	Physical meetings Characteristics of the VCoP Relevance Responsible members Critical mass
3. Maturing phase	Reducing time and costs Characteristics of the VCoP Relevance Critical mass
4. Maintaining phase	Characteristics of the VCoP Availability of knowledge Better project management Relevance Responsible members Critical mass
5. Transformation phase	Characteristics of the VCoP Physical meetings Relevance Critical mass Responsible members

Table 5.11: Important factors per VCoP phase

The factors that are important to the different VCoP phases have a lot of overlap. In every phase the relevance (i.e. the goals, purpose, and value) of the VCoP is considered to be very important.

"It needs to be made clear where the VCoP should and could be used for"

It is also important to have responsible members in the VCoP which motivate the other community members, and keep the community together.

"A motivated, active, and involved person needs to pull the community"

Furthermore, a critical mass is seen as quite important in most phases. A critical mass is the number of people that actually use the VCoP. It is important to make the community of the VCoP active.

"When enough community members start participating, others will follow"

However, a critical mass and responsible members are not important in all phases. In phase one a critical mass is not considered important. This can possibly be attributed to the fact that the VCoP needs to grow in this phase. Responsible members on the other hand are not necessarily needed in phase three. This may be explained, because community members work in an optimal condition in that phase.

The factors: physical meetings; characteristics of the VCoP; reducing time and costs; availability of knowledge; and better project management, are going to be described in the next paragraph. This is done, because these factors are considered to be critical success factors, and it prevents repeating.

5.1.3 Concluding the VCoP process model

As made clear in the previous section, the VCoP process model consists of five phases. The phases can be run trough in different orders (Wenger et al., 2002a). However, phase one is always the start, and phase two is at all times the follow up phase.

In total, nine different stages could be identified in the VCoP process model. These stages all fall under phase one, and describe the process from forming the idea of starting a VCoP to the actual launching of a VCoP. The stages are fundamental for the VCoP development process.

The stages could be executed in a chronological order, but that might not always be possible. It is plausible that during the development process, some things may change (e.g. the goal of the VCoP, or the tools that will be used). This does not mean that it is necessary to go back to one stage. The development process can continue, but the changes should be carefully recorded.

5.2 Research results: setting up the VCoP factor model

In this paragraph, the ultimate goal is to present the VCoP factor model. However, this can not be done without some preliminary steps. First of all, the research results from the questionnaire are presented. This is followed by summing up the factors that are important considering the success of VCoPs (i.e. the critical success factors). In the third section, the factors that are important to community sizes are tackled.

5.2.1 Attitude of researchers towards VCoPs

In the two weeks the survey was online 102 responses were returned. However, some questionnaires were not completely filled in. Some were half empty, while others only missed a few questions. In total 87 responses could be used. The respondents of the survey are all working for TNO. 67.8% is male and 32.3% is female. The age of the respondents varies between 22 and 60 years. The mean age is 37.5.

Before describing the factors, which determine the success of virtual communities of practice for European research projects, first sub question two *(i.e. how do researchers perceive the idea to work with a virtual community of practice in European research projects)* is answered. The specified questions of sub question two, and the corresponding results are presented in the box on the next page.

- *Do virtual communities of practice for European research projects provide added value according to researchers?*

This question was very positively answered by the researchers which filled in the digital survey. About 95% of the 87 respondents addressed that a VCoP for European research projects will have added value.

- *Is the integration of a virtual community of practice in European research projects realistic according to researchers?*

Of the 95% that attributed that VCoPs can have added value for European research projects, more than 90% thinks that it also a realistic thought to actually set up such VCoPs.

- *Will researchers actually use a virtual community of practice for European research projects, once it is made available?*

When asking the respondents if they think that such a VCoP will actually be used by project partners, they are not extremely positive. However, about 70% still is.

- *Will researchers put their own energy in the development process of a virtual community of practice for European research projects?*

The respondents are not collectively interested in putting energy in the start up phase of a VCoP. This can be due to lack of time and/or technical skills. Then again, almost 40% is willing to do this.

5.2.2 The VCoP factor model (critical success factors)

In this section the VCoP factor model is presented. This section also answers sub question five *(i.e. which factors, which determine the success of a virtual community of practice, can be attributed to virtual communities of practice for European research projects?)*. The VCoP factor model includes those factors that are found to be very important by researchers.

The figure from paragraph 2.4, which contained the factors that might influence the success of a VCoP for European research projects, was constructed in a fishbone diagram. A fishbone diagram is also used to construct the VCoP factor model.

According to SPL (n.d.), constructing a fishbone diagram takes six steps. The first step is to identify the outcome (i.e. the effect). In this case the outcome of the fishbone diagram is successful VCoPs for European research projects. The second step is to draw a horizontal line (i.e. the spine), which points to the right. The next step is to identify the main causes. The main causes in this case are: community challenges; personal challenges; management challenges; and technical challenges. The main causes are attached to the spine. As the fourth step, the factors for each main cause are identified. The factors are described in more detail after the general description of the fishbone diagram. This could be followed by identifying more in depth levels of the causes, but that is not done within this report. The final step is to analyze (and validate) the fishbone diagram. The fishbone diagram described in paragraph 2.4 is analyzed and validated, which means that the following figure (see figure 5.3 on the next page) is the final VCoP factor model.

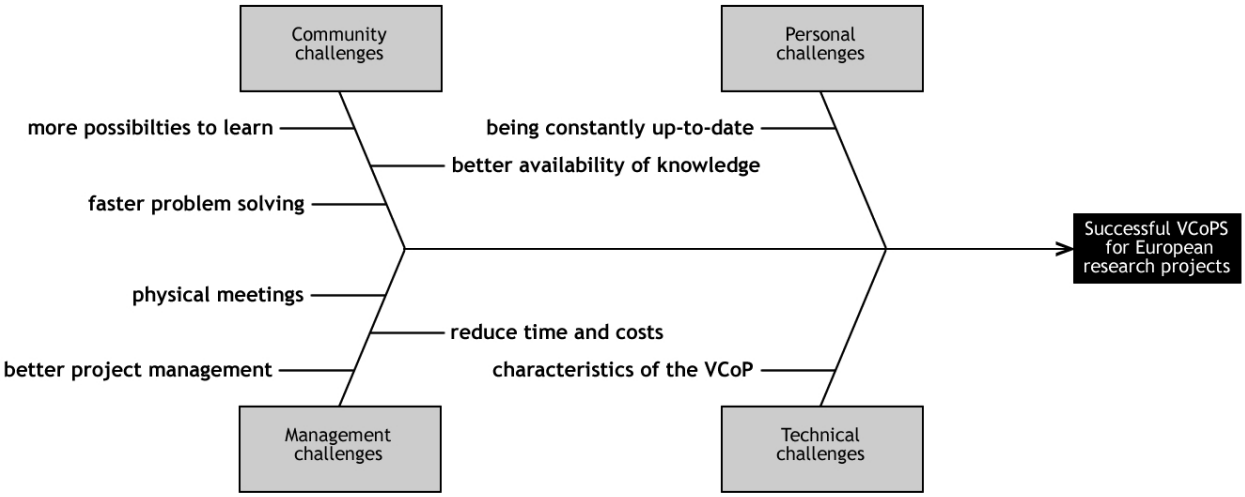

Figure 5.3: VCoP factor model

The VCoP factor model explains the critical success factors of a VCoP for European research projects. The main causes and the grouping of the factors are validated by conducting the cluster experiment. From the twenty-nine factors, eight factors can be labelled as critical success factors. The factors are summed-up in a chronological order based on their ratings: better availability of knowledge; being constantly up-to-date; faster problem solving; reducing time and costs; more possibilities to learn; physical meetings; characteristics of the VCoP; and better project management. The reasons why these eight factors are critical success factor are explained next.

- **Better availability of knowledge** (e.g. finding useful and qualitative information)

  This factor is seen as the most important factor of the critical success factors. According to some participants the VCoP could function as some sort of encyclopaedia where all kinds of information are made available. However, another participant mentioned that the purity of information is considered to be very important. Otherwise the VCoP just becomes the next source on the internet.

- **Being constantly up-to-date** (e.g. access to recent research; discover trends; and respond to changing markets)

  This factor is important in a VCoP for European research projects, because it is seems difficult to be fully up-to-date when trying to do so alone. When the VCoP is used by many others, it is plausible that many useful (news) topics will be posted, which keeps people up-to-date with their specific domain. This means that the information density increases. One participant mentioned that the level of actuality should be high in a VCoP.

- **Faster problem solving** (e.g. asking and answering questions)

  This is, according to the participants of the cluster experiment, one of the main reasons why VCoPs for European research projects are useful. The positive thing about this is that asking and answering questions can be done faster when such a VCoP is available.

- **Reducing time and costs** (e.g. work more effective and efficient; speeding up research process; and replace physical meetings)

There are many possibilities to work more effective and efficient (e.g. quick and fast discussions) when working in a VCoP. This reduces time when having to make appointments and the like. The costs can also be narrowed when conducting such things online. In this manner, project partners do not have to travel to each other. This is especially beneficial for smaller meetings.

"The VCoP can make doing the job easier"

- **More possibilities to learn** (e.g. increase knowledge; and easier exchange of experiences and best practices)

  According to participants, learning is where the VCoP should be all about. The participants recognize that this can be easier done in a VCoP than in the real-world, because knowledge, experiences, and best-practices can be easily stored, and exchanged. Moreover, more community members are enabled to put their information on the VCoP and have the opportunity to discuss it with others.

- **Physical meetings** (having physical meetings besides online meetings only)

  Physical meetings are perceived by the participants of the cluster experiments as essential for a VCoP to succeed. This is because non-verbal communication is essential, and social communication is elementary. These two issues can, according to the participants, only be achieved when meeting in a physical way. Besides that, physical meetings will also motivate people to work in the VCoP. Although physical meetings maintain important when a VCoP is available, the frequency can be lowered.

"Community members will get active
once they know who the other members of the community are"

- **Characteristics of the VCoP** (e.g. user friendliness; security; and simplicity)

  The characteristics of the VCoP are also important to the success of a VCoP for European research projects. It is important that the VCoP is easy accessible and user friendly. When this is not the case, the VCoP will not be used. In other words, easy accessibility determines the survival of the VCoP. One participant added to the key words, that it is also necessary that a VCoP is low on costs. Another participant added that a netiquette should be integrated. Some statements by participants who address this need:

"Technology should do most of the work"

"Make use of the technical possibilities, without excluding anyone"

"The VCoP should fit daily practices"

"When the VCoP is easy to use, the barrier for not participating can be lowered"

- **Better project management** (e.g. better monitoring of research project; and watch what others are doing)

  The last critical success factor is better project management. A VCoP can help in maintaining the overall picture. It is also applauded by participants that it is worthwhile to see what other community members are doing. In this way community members can get new ideas and insights, and can perhaps discover possibilities for cooperation. However, one note has to be made. The VCoP should not act as a control utility. This will reduce member's motivation to participate in the VCoP.

5.2.3 Less important and unimportant factors

In this section, the factors that were rated 'slightly important' and 'not important' are addressed. First, the slightly important factors are dealt with. This is followed by presenting the unimportant factors, and the reasons why they are considered unimportant.

The factors, which are slightly important, must still be taken into account. These factors do probably not make the difference for a VCoP to become successful, but when not taking them into account it could make a VCoP unsuccessful. The slightly important factors are: stimulating to cooperate; more professional contacts; synchronicity; relevance; shared public space; more room for discussion; having a broad perspective; more possibilities for innovation; intangible rewards; moral obligation; networking; more room for social interaction; sub-communities; a-synchronicity; responsible members; and critical mass.

From the twenty-nine factors that were measured in the survey, four were considered not important. These factors are: professional development; technical development; personal development; and rewards. Although these factors seem to be important at first glance, they are not. This is due to the keywords that describe them. The participants from the cluster experiment also rated some of these four factors as not important. In order to give an explanation why these factors are excluded, some comments by those participants are presented.

- **Professional development** (increase competencies, get better in job)

  According to most participants, professional development is not done within VCoPs.

  "Professional development is gained by experience"

  "Professional development is done in training sessions or by reading books"

  Although participants from both the survey and the cluster experiment rated this factor as unimportant, the researcher finds this remarkable. One of the most important goals in a VCoP, as described in chapter two, is to become better in job.

- **Technical development** (learn to better use technology)

  For technical development similar reasons compared to professional development come into play. A VCoP is perceived to not be a place to learn working with technology. It is expected that people who are going to use the VCoP already know how to use technology.

  "When someone wants to gain more technical skills, they should follow a course"

- **Personal development** (increase social skills)

  Personal development is according to most participants, something which can only be realized during physical meetings. Although virtual contact can be highly social, it is not perceived that way by the researchers that filled in the questionnaire or cooperated in the experiment. Anonymity is seen as the major pitfall in this. According to one participant this factor should be a prerequisite when joining a VCoP.

- **Rewards** (possibilities to publicize own research, possibilities for promotion)

  Rewards are also not important. According to one participant this can lead to selfish behaviour.

  "We do not want to have a 'Johnny the self-kicker' in our team, do we?"

Another participant mentioned that in his field of work (i.e. IT) reciprocity is seen as more important. In this case people are indirectly rewarded when giving information and getting useful information back in return. The informal nature of exchanging knowledge is the most important thing in a VCoP. Moreover, when the informal character of the VCoP disappears, this participant believes that people will drop out.

"Motivational rewards like money are absolutely not necessary"

5.2.4 Important factors per community size

During the cluster experiment, it was asked for which factors are most important when presenting three different VCoP sized. This was done, in order to try to get an answer to hypothesis one. H1: *The influence of the factors, which determine the success of virtual communities of practice for European research projects, depends on the size of the community.*

There are differentiated three different community sizes within VCoPs (i.e. small; medium; and large communities). Per community size, the factors that are important are mentioned. The factors are presented in the table below (see table 5.12).

Phase	Factors
Small (less then ten members)	Characteristics of the VCoP Relevance Responsible members Synchronicity (reduce time and costs) More possibilities to learn Stimulating to cooperate
Medium (between ten and one hundred members)	Characteristics of the VCoP Relevance Responsible members Being constantly up-to-date More room for discussion Sub-communities
Large (over one hundred members)	Characteristics of the VCoP Relevance Responsible members Networking Critical mass

Table 5.12: Important factors per VCoP size

The factors that were mentioned in all three community-sizes are: the characteristics of the VCoP (e.g. user friendliness and accessibility); relevance (e.g. goals and purpose); and responsible members (i.e. people who pull the community to participate). Below, the community sizes and their description are shortly highlighted, together with the individual factors.

A **small community** that uses a VCoP is probably the most effective one. The VCoP has clear goals and purpose, and there are good opportunities to learn and work together (e.g. working in documents). However, some participants asked the question if in such small communities, a VCoP in terms of an advanced web site with all kinds of integrated tools is really necessary? One participant stated that a project web site with a project directory is adequate enough. When there would be room for such a VCoP, another participant mentioned that the community itself should be reliable.

Video conferencing is very profitable in this kind of community. A lot of time, and thus money, can be saved when using video conferencing over physical meetings. Another participant stated that there are no factors that would really make a difference, because of this small group. Furthermore, in a small community people know each other often very well. Although this might be true, it is important to design the VCoP in such ways that it unites with the daily practices of the users.

A **medium-sized community** is seen by the participants as an ideal size. This counts especially for being kept up-to-date in the research domain, as well for being able to discuss effectively with community members about research topics. However, one participant disagreed with the last consideration. He reflects that not everyone can be heard when a community grows over thirty people, and thinks that such a community probably fails. According to one participant it is good to design such a VCoP for a core-group (e.g. the project partners) and to make a shell for other community members (with other functionality) around it. Having good VCoP management and administration is very important for a VCoP of this size.

A **large community** is perceived by the participants as a network community. It is very difficult to cooperate, and discussions do probably not work. One participant countered this thought and mentioned that in such a community it would be useful to have discussions. In a large community many different perspectives can be heard. Nonetheless, it is important that the perspectives are related to the domain of the VCoP. A large VCoP should be core-group driven with others around it. Because networking is important, there need to be good user profiles. Having good VCoP management and administration is also important for a VCoP of this size. A final point of consideration is that a large VCoP should only provide abbreviated information, in order to exclude information overload.

To conclude this section, it can be stated that small and medium sized communities have the best potential to generate knowledge and to cooperate. However, in a medium sized community, cooperation should take place in smaller groups by forming sub communities. A large VCoP on the other hand is seen as a networking mechanism. In such VCoPs, the emphasis lies more on using the network of people to engage in new projects and the like, then to collaborate and generate new knowledge. Having a VCoP that is easy to use and easy accessible, with a clear goals and purpose, and having responsible members is important in all VCoP sizes.

Although there are no quantitative results that could reject or accept hypothesis one, the researcher believes the hypothesis can be accepted.

5.2.5 Concluding the VCoP factor model

It is made clear that there are eight critical success factors which determine the success of VCoPs for European research projects. This means that when a VCoP is developed for such projects, it will become successful when those eight factors are applied.

The factors that were rated as less important still need to be taken into account. These factors may not enhance success, but could be prerequisites for a VCoP to function and survive. Besides that, it is important to use the VCoP process model as well. Project specific requirements may come up, which are also important to VCoP success.

A final point for consideration is to take the factors in mind that are described for the different community sizes.

6 THE SCORE! VCOP

There are risks and costs to a program of action - but they are far less than the long range risk and costs of comfortable inaction (John F. Kennedy)

This chapter deals with the practical part of this thesis. In this chapter, the VCoP process model, the VCoP factor model, and SCORE! related issues, gathered form three research methods, are combined to give an advice to the project managers of SCORE! how to set up a successful VCoP for their project.

6.1 Research results: setting up the SCORE! VCoP

In this paragraph, setting up the SCORE! VCoP is carefully described. This is done by outlining each phase and stage from the VCoP process model. However, one note has to be made. Because of time constraints, not every step can be described in full detail. In those cases, the researcher presents suggestions how to handle it. The research results of the interview, the survey, and the field test with SCORE! community members are processed as well.

- **Phase 1: beginning**
  This phase is explained by giving extensive explanations of what to do during the nine stages that are identified to belong to this phase.

- **Stage 0: the identification stage**
  In this case, the identification stage started in 2005 when the SCORE! project was approved by the FP6. The project managers of SCORE! gathered all kinds of interesting and knowledgeable experts in the domain of sustainable consumption and production, which were believed could give useful contributions to the project.

  SCORE! started off, just like many other research projects, with a web site which contains basic information about the research project. There was also put a discussion forum on the SCORE! web site, so a small move towards doing something virtual was made. However, this initiative failed. There was no energy put in the discussion forum, so it died a peaceful death.

  Over time, there were organized several activities around SCORE! and that will continue in the near future. The goals of the project and the needs of the community are met by these activities. However, the community desires to work more efficiently. Although the first initiative to go virtual failed, the project managers identified the idea to create a VCoP for SCORE!

  Before shaping the VCoP idea into concrete actions, it is necessary to get approval from the community first. During interviews with the SCORE! community, it became clear that the idea to continue with the SCORE! project after its official end in 2008 was welcomed.

  "Keeping such a large international community together is great."

  Besides liking the idea to continue with SCORE! the idea to create a VCoP around the SCORE! project was positively received as well. This positive outcome was also attributed by the SCORE! members who filled in the questionnaire. A large percentage even stated to be happy with the development of a VCoP. Moreover, during the round up session at the SCORE! workshop in Paris, the project manager initiated a quick vote round, in order to see who is in favour of this idea. About half of the SCORE! community, who were visiting the workshop, voted 'yes'. It can therefore be concluded that it is worthwhile to try setting up a VCoP for SCORE!

- **Stage 1: the inspection stage**
  In this stage, the steering committee (in this case the project managers, or the co-ordination team of SCORE!) needs to think clearly about the purpose and goals of the VCoP. Because the VCoP is set up two years after the start of the project, it is advisable to state the goals in line with the current goals of the project. The purpose and goals need to be clear to the community right from the beginning. Only then, the members of the community see the possible value of the VCoP. As stated in chapter three, there are four purposes why a VCoP is important to the SCORE! project. These four purposes are:

  - It will be the first VCoP around sustainable consumption and production
  - It will make cooperation between physical meetings more effective and efficient
  - It will make publicizing of research more easily
  - It will maintain the community when the SCORE! project officially ends

  These four purposes are short-term goals. It is also important for the steering committee to inspect the long-term goals of the VCoP. This is important, because the purpose and goals of the SCORE! VCoP may differ once the project has come to its official end.

  Furthermore, the steering committee needs to think clearly about the role it will play in the VCoP. A VCoP for European research projects is preferred to be ruled top-down. This means that the steering committee at least has some leading role. In order to make the SCORE! VCoP a success, this is a crucial stage. In this stage, an active steering committee is essential. The steering committee needs to define the VCoP concept for its specific project as well. There is no project manager during the stages when the VCoP is set up, because that part is filled in by the researcher.

  The researcher conducted an inspection of the requirements, another important action during this stage. In order to gather the requirements, some interviews were taken with SCORE! members. The requirements that could be identified are:

  - Finding the latest research available
  - Seeing what other researchers are doing
  - Networking
  - Publication possibilities (e.g. journals and books)
  - Having access to experts and expertise
  - Reducing time and costs

  Two other requirements could be obtained from the questionnaire with SCORE! members. These two requirements are:

  - User friendliness of the VCoP
  - Preservation of physical meetings

  It is however not only important to understand the needs of the actual users of the VCoP. It is also fruitful to understand the underlying motivations of the SCORE! members to actually use the VCoP. It is a positive result that almost 80% of the SCORE! community is motivated to use the SCORE! VCoP, but what are these motivations?

  A much cited interest and motivation are case studies. Not only do the SCORE! members like to see and hear about other cases, they also like to present their own cases. When seeing what others are doing, a duplication effect can be countered and possibilities for cooperation can be identified more easily.

  The participants showed much interest and motivation for the (active) network around the SCORE! project. Besides the good quality and the interesting mix of researchers, the network also provides project ideas. SCORE! has the advantage that its members understand each other's language, which makes it possible to constantly build on ideas. Publicizing own research is perceived as an important motivation as well. As for the possibility to publicize in journals, one participant stated:

"Although working on a journal is a major commitment, and the stakes would become much higher, it would really motivate the SCORE! community"

Physical meetings (e.g. workshops and conferences) also play a very important part in the SCORE! project. Most members are part of the project, in order to learn something and to exchange information.

Besides motivations to work in a VCoP that are related to the requirements, some other motivations could be extracted from the interviews with the SCORE! community as well. Many participants pointed out that they are motivated to work in a VCoP when there is some kind of economic compensation (i.e. monetary rewards). As one participant stated:

"It is an ethical thing to be motivated, but money is needed – we need to stay in the market"

This statement is however, the opposite of the results found in the digital questionnaire. The researchers who filled in this questionnaire collectively agreed that rewards are an unimportant factor for European research VCoPs. Moreover, of the SCORE! members who filled in the questionnaire, about half of them indicated that they would use the VCoP of SCORE! on a voluntary basis as well.

Something that would make SCORE! even more interesting, but which is not present right now, is the focus on policy and the ways to convince them to make some real changes.

"The SCORE! community can be convinced during physical meetings, but that does not mean anything - in order to make changes others need to be convinced as well"

Another motivation attributed by a respondent is that when introducing a VCoP for SCORE! opportunities exist to move beyond the European borders. In addition, the coupling between production and consumption is considered to be important as well.

"This coupling is something that nowhere else is done"

A point of improvement over the current state of the SCORE! project, which could be enhanced in the SCORE! VCoP, is to focus more on output and evidence-based research.

"Discussions are often good on contents, but you never get something concrete out of it"

- **Stage 2: the decision stage**

  This stage deals with two issues. The first issue that is highlighted is how the SCORE! VCoP is organized. The second issue deals with what kind of tools need to be integrated in the VCoP. When additional explanation of the tools is needed, consult Appendix V.

  Issue 1: Before actually going deeper in the first issue, another decision in the case of SCORE! had to be made. There were two possibilities to continue with the SCORE! project. The first possibility was to set up its own VCoP, which was applauded by many SCORE! members. However, there was also a possibility to join an existing community, or VCoP. About half of the SCORE! members that were interviewed liked this idea as well. Two reactions why joining an existing project or VCoP is a good idea were:

  "There is already so much out there"

  "SCORE! could join the CSCP community, because of the mandate to contribute to the Marrakech process"

Participants against joining an existing community or VCoP addressed issues like:

"SCORE! does not fit within other organizations"

"SCORE! should create a home around its domain for the different disciplines"

Because SCORE! is hard to put in box, and because it is rather difficult to join a community that really fits, the idea of setting up a SCORE! specific VCoP was persisted.

It is advised to design a VCoP for research projects top-down. This also needs to be done in this case. The top (i.e. the steering committee) has made clear what the goals and purposes are, and the bottom (i.e. the community) will fill it in. Nevertheless, when the research project has come to an end, it would be the ultimate goal to let the VCoP fill itself by a bottom-up approach.

The steering committee should think of rules that can be put in the netiquette. These are the guidelines for the users how to use the VCoP. This can best be done in cooperation with the developer of the VCoP. This person might have experiences with netiquettes and could provide excellent help. The netiquette will probably evolve over time, but it is necessary to start off with some general rules, in order to guide the community members.

Besides that, the steering committee needs to make clear to whom the knowledge in the VCoP belongs (e.g. protected, or free to use by anyone). If it wants to protect the contents within the VCoP, it should communicate this clearly on the VCoP, and it is advised to set up legal contracts.

In stage one, the steering committee made clear what kind of role it will play in the VCoP. In this stage, it is important to illuminate what is expected from the community members to do within the VCoP. Furthermore, it is important to make a decision about who the VCoP facilitator is going to be. It is advised that the steering committee chooses a well motivated community member who wants to carry this burden. This person plans several activities around the VCoP, promotes the VCoP to the SCORE! community, and coaches them when they have questions. The activities of the facilitator take place at all phases a VCoP can be in.

The steering committee also needs to find a moderator who can handle the technical issues of the VCoP (e.g. solving technical problems and providing user support). This could be a member of the community who is experienced with technology, but when the VCoP is much used, time to take care of things becomes too demanding. It is therefore advisable to look for a moderator outside the community who can manage the technology, but who can also take care of the administration activities in the VCoP.

Another important decision to make for the steering committee is the membership criteria. SCORE! is a large network, which means that closed memberships will not work. However, when going for open memberships, it is advisable that some sections are not accessible to all. For example, information should not be editable by just anyone who is a member of the SCORE! VCoP. It is therefore necessary to assign 'rights' in the VCoP. This means that a selected group of community members has the right to edit things, while others only have the possibility to read it. These things need to be carefully decided for in this stage.

Furthermore, the steering committee needs to decide if it wants to let its VCoP members pay for using a VCoP. Although this might generate the funds that are necessary to support the VCoP, it is presumed that people will not join the VCoP when they have to pay for it. Besides that, registering and logging in should be easy processes, otherwise people will adjourn.

The last direct issue the steering committee needs to make clear is how the goals and purposes of the VCoP are going to be measured. Otherwise it is impossible to understand if the VCoP is a success, or that it needs to undergo some serious interventions.

Issue 2: In stage one, the requirements of the SCORE! community are gathered. These requirements are transformed in the tools that need to be integrated in the VCoP, in order to meet the needs of the user. Before the tools are presented, the technology structure of the SCORE! VCoP is addressed first.

❖ **Technology structure**

The technology structure that is used for the SCORE! VCoP is developed in KASS (i.e. Knowledge Activating Software System). This system is developed by Konict B.V. (www.konict.nl) and can shortly be described as a content management system with communication possibilities. There are several motivations why using this system. The system can provide user friendly structures, which is important to the user. The system is flexible and easy modifiable, which is a prerequisite for a VCoP structure, because the goals and thereby the functionality of a VCoP can change over time. The system includes the W3C guidelines (see Appendix I). The last motivation to use this system is because of its WYSIWYG-editors (i.e. 'what you see is what you get' editors). This makes using the VCoP easy for both the community members, and for the steering committee. This is necessary, because both groups do not have technical backgrounds.

It was also an option to use the actual SCORE! web site and to integrate it with all kinds of functionality. However, the structure of the SCORE! web site did not allow for this. Moreover, different kinds of software from different developers needed to be used in that case, which would negatively affect the consistent look and feel of the VCoP.

The structure of the VCoP is created around the SCORE! co-ordination team. These community members have all the rights to add information, make changes, etcetera. They are the core of the VCoP. In a shell around it the other community members are placed. These members have limited rights, which are given to them by the VCoP moderator.

In section 5.2.5 it is made clear that different factors are important for different community sizes. Because SCORE! has over a hundred members, it can be considered a large community. In a large community it is stated that cooperation is difficult. Cooperation is however something that is important to the SCORE! project managers to achieve with the VCoP. For that reason, it is important that the technology structure allows for sub communities to be formed.

Now it is time to introduce the features and tools that are integrated in the SCORE! VCoP. The features and tools that are addressed in this section are: library; search engine; wiki (for mind map; terminology; and collaboration); networking; publicizing; web log (for conversation and discussion; and news and events); and video conferencing.

❖ **Library**

The SCORE! community addressed the need to find the latest research available. This means that community members must be able to download, but also upload documents. Therefore a library (i.e. online repository) should be integrated. At the moment, the SCORE! members do not consider a library as 'very necessary', because there are not many documents online. Nevertheless, when the VCoP is used in a large extend, a library is needed. Otherwise the documents are ordered in inconvenient ways. This means that the library needs to have a good structure. When the library has a good structure, it allows community members to find information faster.

One participant mentioned that she was not able to upload documents on the SCORE! web site. This kind of problem causes barriers which are not desirable in a VCoP. Besides documents, the library can be used to store podcasts and video files as well. These can contain audio and/or video recordings from conferences and workshops. Community members who were not able to visit the SCORE! meetings can download them and listen to and/or watch them. Although a library is necessary, two participants were doubtful about integrating a library in the SCORE! VCoP.

"You have to update it, organize it, categorize it, and it needs funding – if it can not be done right, than do not do it at all"

"Using a library comes on top of exchanging documents in a conventional matter"

These comments are of course true and need to be taken into account. Furthermore, the library is assisted by RSS and by email notification. These two concepts are explained later on.

To conclude, when using a library it is essential to work with versions of documents. It is advised to only let the latest versions be online.

- **Search engine**

When a library is integrated in the VCoP, a search engine is needed as well. The search engine is an essential part of the library. Otherwise the content can not be controlled.

Besides using a search engine for the library, an overall search engine is also needed. This search engine scans the whole VCoP. This is especially necessary when a VCoP is growing big. Because SCORE! has a large network this is likely to happen.

- **Wiki (mind map)**

The SCORE! community collectively made the statement that they would like to see what kind of research and projects other community members are involved in, and in which institutes that happens. An adequate way to provide such insights is by using an online mind map. A mind map provides an overview of who does what, where, and how. An excellent way to design such a mind map is in the form of a wiki. The advantage of designing a mind map by using a wiki is that wiki's have the advantage to be easily updated. This means that research progress can be easily adjusted for example. Although it is nice to see what other members are doing in a mind map, the goals of a mind map should be communicated very clearly and specifically. Otherwise, community members might perceive the mind map of some kind of controlling system.

- **Wiki (terminology)**

Besides using a wiki for the mind map, wiki's can also be used for presenting the terminology of the research project. This is often done in a Word-file, but when presenting it in a wiki it is quickly available, and easy editable. Moreover, one participant mentioned:

"You can find things very easily in a wiki"

Next to using a wiki for the terminology, there could furthermore be room for presenting project generalizations and best practices (i.e. rules of thumb). As one participant mentioned:

"People need well-told stories"

Currently there is not such a thing as a terminology for the SCORE! project. Constructing the terminology section could be an appropriate task to do within the SCORE! VCoP.

❖ **Wiki (collaboration)**

The last thing a wiki can be used for in the SCORE! VCoP is for the means of collaborative purposes (e.g. writing in one document). This can be helpful for workgroups who want to develop a document together. According to two participants, a wiki prevents community members to first download a document, then to adjust the document and then to upload it again. This takes too much time, plus that there is a fair chance that there will be ten different versions of one document in the end. Besides this, changes in a wiki can be easily undone.

❖ **Networking (user profiles)**

Using the SCORE! VCoP for the means of networking is a many cited need of the community. SCORE! is all about connections. Therefore, it is necessary to integrate user profiles. This is also done on the web site of SCORE! However, some participants find it to be inadequate. One participant even stated that she doubts if the user profiles are up-to-date, or not.

"I always have to check myself"

User profiles are not only an essential feature for community members, but also for the VCoP in general. It gives the VCoP a reason for existence. The user profile should consist of a name, a picture, a telephone number, an email address, a description of one's function, and a link to the institutional web site. More information should not be included. Otherwise, constant updating is needed. When community members want to know more about someone, they can click on the link for more information. The user profiles should be easily creatable by the community members, preferable with a template.

Because SCORE! already has a web site with several registered members, the profiles of these members have to be transferred to the VCoP.

❖ **Publicizing (journals and books)**

A fruitful thing to do in a VCoP is working on journals. SCORE! members showed much motivation for such an idea. It could also be an interesting option to give them possibilities to publish their research in a so-called 'e-zine' (i.e. an electronic journal). An important motivation for the SCORE! members is that they would like to see rewards. Publishing own research in a journal can be rewarding. It can for example provide publishing points, but that depends on the nature and the status of the journal. Writing books can be done in a VCoP as well. Community members can write chapters in wiki's and others are able to correct things if applicable.

❖ **Web log (conversation and discussion)**

From now on tools that are not specifically attributed by participants from the interview, but which are important to VCoPs are described.

According to Wenger (2005) a VCoP should provide conversation tools. A qualified tool for a-synchronous conversation and discussion is a web log. A web log is recommended over a discussion forum, because a web log has several important benefits. Besides that, discussion forums do not have a good reputation within the SCORE! community. One participant even stated:

"All forums are a bad idea - every forum I know of is a failure"

Web logs can have a high level of societal or even political influence. Web logs generate loads of key words which makes them easy to find when internet users are using search engines (e.g. www.google.com). When things are easier found on the internet it can generate more familiarity. When web logs are used, the community can express itself and show their level of expertise to the world. In order to show their expertise, it needs to be done in a format that is not only accessible for the SCORE! members, but also for the audience (e.g. policy makers; consumers; etcetera). Two participants attributed the following to this issue:

"The thoughts of SCORE! need to be translated in the language of others"

"We need to create a strong voice from different perspectives –
a strong voice provides credibility to policy makers and to the world"

In order to let this work, community members should be motivated to read and react on web logs, but moreover being motivated to write some interesting things themselves. This is however not an easy task. Some participants may be redundant to do so.

"When I discuss here (i.e. physical meetings), I have no need to discuss again virtually"

In order to cope with such comments, the steering committee should take an active role in addressing the importance of contributing to the VCoP. This should be done by constant repeating it until the community is contributing enough. Besides doing this in a virtual way, physical meetings should be used for this as well.

Furthermore, participants have claimed to not use the SCORE! forum, because it had no use to them (i.e. the goals are unknown). This is an important issue to consider, because such problems can also be experienced with web logs. It is therefore very important that the discussions have a clear goal and purpose. Frequent posts are moreover needed to keep the VCoP running and interesting for the community members.

It is however not encouraged to introduce personal web logs. The SCORE! community indicated to use the VCoP primarily for professional purposes rather than for social purposes. However, a link to the personal web log could be provided in the user profiles.

- **News and events**

Standard information like news and events, which can often be found on web sites, can also be designed in web logs. Besides that they can be easier localized, it gives the community member an opportunity to react on it, which can provoke useful discussions.

News is necessary to integrate in the SCORE! VCoP, in order to enhance the level of actuality. It also provides community members to be up-to-date in the domain of sustainable consumption and production.

Physical meetings are still important when using a VCoP. It is therefore important to communicate SCORE! and related events in the VCoP. One criterion here is that community members must be able to subscribe to SCORE! events.

- **RSS (really simple syndication) and email notification**

RSS is, besides for the library, very important to integrate in the functions that make use of web logs. When community members subscribe for RSS feeds, they are automatically kept up-to-date when new contributions are made. The SCORE! community is an occupied target group, which means that it needs to be updated in fast and efficient ways. It does not have time to visit the VCoP every day, and to search for new information. RSS keeps the VCoP interesting for the community.

Because not everyone will use RSS, also email notification is implemented. This means that when something is posted, which is relevant to the community or a group of the community, an email can be sent to those who need to be made aware of it. The difference between the two is that RSS is receiver oriented, and email systems are sender oriented. Email might still be needed, because RSS may not be easy to use for all members.

❖ **Video conferencing**

According to Saint-Onge and Wallace (2003) tools in a VCoP should facilitate rich conversations as well. Conversely, most participants claimed that such tools do not need to be integrated in the SCORE! VCoP. In stead, the SCORE! community prefers conventional tools. Because discussions often take place in small groups, conventional tools like Skype, email, or even telephones are adequate enough. Moreover, when one wants to discuss something, it is often realized in a proactive way. When letting community members stick to the old methods, which are working properly and where they are used to, they do not have to learn new things. One participant explained:"

"If people need such tools, just tell them that it is there"

Another participant expressed negative experiences with new technology. This was mostly due to technical problems. When letting community members use their own trusted equipment they are able to work in the ways they are working now. Another benefit is, because technology is updated constantly, that updating all kinds of technology is not necessary in the VCoP.

Although the participants indicated that conventional tools are good enough, there are some circumstances that allow synchronous communication tools to be used. Video conferencing can be useful for specific tasks like discussing and presenting things with distributed audiences.

"It has low costs, and it works fantastic"

One participant did not like video conferencing so much, and indicated that it would be more useful to use audio conferencing. Nonetheless, video conferencing is preferred over audio conferencing, because of language and visibility barriers. In conference calls for example, certain social cues (e.g. not being able to see each other) are missing and the discussion can go wrong (e.g. difficulties in changing turns). Besides that, it is often unclear who is talking, especially when community members have not met very often. Also community members with great English skills can turn the conversation easily in their own direction. One participant from the cluster experiment claimed that video conferencing is one of the more important reasons to work with a VCoP.

A wish of the project managers of SCORE! is to integrate a video conferencing tool where community members can see each other, hear each other, but furthermore are enabled to present each other documents, and to work with each other in one document. This tool is unfortunately not available yet.

The KASS system itself provides no possibilities for video conferencing on this moment. This means that a stand-alone tool needs to be used. When wanting to use a tool that provides video conferencing and the possibility to share a desktop and to present documents a tool like WebEx, or E/pop needs to be acquired. These tools are however not cheap. There are also no finished open source video conferencing tools available at the moment which can provide this functionality.

WebEx was tested in the field tests. It is not the easiest tool to use, but it provides the opportunity to present documents and to show ones desktop. One participant of the researcher's interview expressed positive experiences with E/pop. E/pop is an expensive tool, but because one of the research partners had this tool available, they could make use of it without any costs. This could perhaps also apply to the SCORE! project. Maybe the project managers of SCORE! need to request such a tool at their research institute. It is cheaper if the organization buys or rents such an application, and distributes it to different projects, than when each individual project needs to do so individually.

If the SCORE! project can suffice with video conferencing only, it is advisable to use FlashMeeting. FlashMeeting can be used for free, and from the results of the field tests it can be concluded that FlashMeeting is easy to use and a good tool for discussions. Community members who want to make use of this tool should be able to register for this on the VCoP. However, at least one of the SCORE! members needs to be a member of PROLEARN (http://www.prolearn-project.org), in order to have the right to book video conference sessions. When this tool is a success in the SCORE! VCoP, the steering committee should consider obtaining a FlashMeeting server. This allows complete control of the (bookings of the) meetings.

To conclude, it is very important that during the video conference sessions a moderator is present to answer questions of community members and to take action when something goes wrong in the session (i.e. technical problems). Also someone that leads the discussion (i.e. a host) is needed in these kinds of discussions, in order to control it. These conclusions are based on the results of the field tests.

❖ **Additional features**

There is also some static information that will be presented on the SCORE! VCoP. There will be an option that describes the SCORE! project. Another option describes the research partners and members of SCORE! It is for European research projects important to show with whom and with what institutes collaborations are concerned. Besides this, standard information like contact information, web links, terms and conditions, site map, and help functionality are presented in the SCORE! VCoP as well.

➢ **Stage 3: the conceptual design stage**

In this stage, it is first of all important to create user profiles. Some characteristics of the SCORE! community are explained in chapter three. However, much of the technical background of the SCORE! community is unknown. The results of the questionnaire distributed at the SCORE! workshop in Paris, solved this issue. The results are presented in underlying box, according to the constructs of the UTAUT model (see section 2.3.4).

❖ **Behavioural intention**

Four constructs were used in the survey to understand the direct behavioural intentions of the SCORE! community towards VCoPs. About 95% of the respondents indicate that they would use the SCORE! VCoP as a source of knowledge. The same percentage points out that they would use the VCoP as a place to share knowledge with other community members. Two thirds of the respondents mention that they would only use the SCORE! VCoP for professional purposes. However, about half of the respondents also indicated that they want to use the VCoP for the means of social interaction.

❖ **Performance expectancy**

The performance expectancy of the SCORE! community is rather sceptic. The expectations of the respondents considering VCoP usage were rather low. About one third of the respondents think that a VCoP will save them time and money, will make their work more interesting, and will increase their technical skills. Increasing personal skills is equally distributed, which means that an equal number of respondents agreed and disagreed with this statement. Performance expectancy rated highest in professional development. Half of the respondents claimed that their professional skills could be increased when working in a VCoP. A small proportion disagrees. It can be concluded that the SCORE! community is not yet seeing the possible benefits a VCoP can provide. This should be communicated clearly by the VCoP facilitator and/or the steering committee.

❖ **Effort expectancy**

The SCORE! community is rather positive towards effort expectancy. Half of the respondents think that the SCORE! VCoP will be easy to use. Nevertheless, a small percentage thinks that they will need much training before they could participate effectively in a VCoP. Despite that the majority of the SCORE! community thinks the VCoP will be easy to use, it does not mean that all community members are able to pull it of that easy. Therefore, it is important to give community members some training how to use certain tools. More about training can be read in stage seven-two.

❖ **Social influence**

Social influence is perceived in two directions by the SCORE! members. On the individual level, the respondents do not expect to be influenced by significant others. Only a quarter of the respondents think that other, meaningful people will influence them to use the VCoP. On the collective level though, two thirds of the respondents state that they will use the SCORE! VCoP when others are doing as well. No respondents disagreed with this. This means that it is essential that the VCoP is pulled by a number of active SCORE! members. More about this can be read in stage seven-two.

❖ **Facilitating conditions**

When talking about the issue of facilitating conditions, the respondents are also sceptical. Although almost 40% thinks that working in a VCoP will fit in the way the respondents are working now, more than 20% disagrees. Also time is seen as a troublesome factor. A quart of the respondents indicated to have enough time to participate in the VCoP. However, the same number indicated that they have not enough time to do this. This means that the VCoP should be easy in its use and that it should not take too much effort. Time, and thus money, is a barrier that needs to be taken seriously. This barrier can be solved during the conceptual design stage, but also during the prototype stage.

It is also important to understand if the target group has some physical limitations. About 90% of the respondents of the SCORE! survey indicated that they have no physical limitations that would influence the way they would work with a VCoP. However, one respondent articulated that he or she might have some limitations. Because the VCoP needs to be accessible to all members this person which resembles a small percentage of the overall community needs to be taken into account. It is therefore important to use the guidelines of the W3C (see appendix I). The other guidelines in Appendix I need to be taken into account as well.

When combining these results with the characteristics from chapter three, the profile of the SCORE! community member can be identified (see table 6.1). The user characteristics are adopted from Stone et al. (2005).

User characteristics	SCORE! community member characteristics
Age	20 to 60+
Sex	Both male and female
Culture	Dispersed all over Europe
Physical limitations	May be fully able-bodied, but can also have some physical limitations
Educational background	Highly trained experts in different fields of sustainable consumption and production
VCoP use	More than fifty percent has no prior VCoP experience
Motivation	Could be very motivated to use the VCoP, but it depends of the purpose and goals of the VCoP
Attitude	Attitudes vary depending on what the VCoP has to offer and the reliability of technology itself

Table 6.1: User profiles of the SCORE! VCoP users

The developer of the VCoP needs to translate the requirements in graphical, functional and technical design. These three designs are not presented within this thesis report, because that is not considered relevant. After some paper sketches a digital sketch was made, which provides a graphical overview of the structure of the SCORE! VCoP (see figure 6.1).

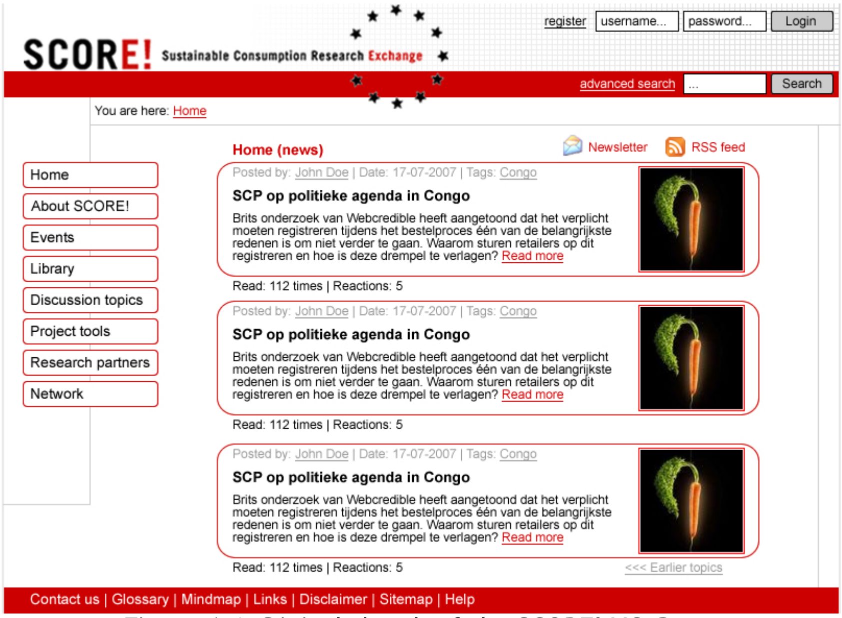

Figure 6.1: Digital sketch of the SCORE! VCoP

The interviews with the SCORE! community also resulted in some useful lessons for designing the SCORE! VCoP. The researcher asked the participants what they did and did not like about the SCORE! web site. This resulted in the following remarks:

- The menu structure should be more conventional
- The time table should be extended with deadlines and deliverables
- There should be made more use of highlighting options
- There should be less information on one page
- There should be given notices when new things are uploaded
- The virtual place should feel more personal

In the description of this stage in section 5.1.1, it is advised to let each stage be evaluated by the end users (i.e. using a user-centered approach). This was not always possible due to time constraints. The different stages are evaluated by the project managers of the SCORE! project though.

- **Stage 4: the prototyping stage**

The description of the technological structure, which was developed in the stage before, is transferred into a real technology structure in this stage. This technology structure is made in KASS. Also the tools that are needed were integrated in this stage.

- **Stage 5: the pre-launce stage**

When the prototype is finished it can be tested by some highly motivated members of the SCORE! community (i.e. the core-group) in a real setting. It is advised that the steering committee provides some tasks for the core-group to perform. This is necessary, because pre-defined goals enhance the motivation of community members in a VCoP.

The core-group should also be maintained after the official launch of the VCoP (see stage seven-one). They are the ones, together with the steering committee, that should pull the community to participate in the VCoP.

- **Stage 6: evaluation stage one – formative evaluation**

Formative evaluation takes place after every stage, ranging from stage one to five. When the SCORE! community is involved in every stage of the process, the chance that the VCoP becomes a success is increased. Success is increased, because formative evaluation makes clear the possibilities to improve the VCoP. Moreover, a user-centered design approach should ultimately be used for any kind of development.

- **Stage 7-1: the launch stage**

When the VCoP is ready to use (i.e. when it is without any bugs or other flaws) it can be launched for all community members. In this stage, all SCORE! members are able to register and to start using the VCoP. After the launch stage, the establishment stage follows immediately.

Furthermore, before the VCoP is launched, it is important to invite community members to the VCoP by sending out an email some time before the VCoP launches. A follow up email could be send right before the VCoP is launched.

- **Stage 7-2: the establishment stage**

In stage seven-two, the steering committee needs to welcome and nurture the community members. This can for example be done by sending out an email to all community members that have registered. It is advised to make a notice that the community members read the netiquette before starting to use the VCoP. Community members that have not registered can be send a reminder to make them aware to do so.

In stage two it was made clear that most of the SCORE! community members think that the usage of a VCoP is easy. In stages three to five everything was done to make it as easy as possible. However, this does not mean that everyone is able to use all the functionality of the VCoP in a proper fashion right from the start. Training sessions are needed, in order to educate community members how the tools can be used, and to make them motivated to use the technology. Moreover, if community members fail to use the technology in a proper fashion, they get easily frustrated with it and will stop using it. The field test showed that the SCORE! community members are easily picking up the technology, which gives a good future perspective.

Because the members of SCORE! are not located closely to each other, it is recommended to demonstrate the tools during physical project meetings. The community members are (all) gathered, and have the opportunity to ask questions and to learn from each other. There could also be made an option available by letting community members work with the VCoP during breaks or demonstrations. In that way, the members are enabled to address questions and trying the solutions out at the same moment. Also members who are afraid to lose face with their questions now have an excellent opportunity to ask them. In this way, time and money can be reduced, because individual and/or online training can be prevented. Besides training, online help (e.g. FAQs (i.e. frequently asked questions) and a user manual) is required as well.

In this stage, it is expected from the VCoP facilitator and the VCoP moderator that they take an active role in guiding and coaching community members if that is necessary.

- **Stage 8: evaluation stage two – summative evaluation**

Summative evaluation takes place during and after each VCoP phase. It is important to evaluate on a constant basis if the needs of the community members are met. If these are not met, the VCoP should be modified. However, the overall goals of the VCoP must be leading in this. When conducting different evaluations, the VCoP can be controlled and monitored in such way that when things seem to go wrong there can take place an intervention on time which could lead the VCoP back in good orbits. It is also recommended to integrate statistical software in the VCoP, in order to monitor the usage within the VCoP.

When the steering committee or the VCoP facilitator has received the results, it is important that it communicates this back to the community members. Both positive and negative issues need to be communicated, together with the success SCORE! has booked by using the VCoP. This enhances the motivation of the community members.

- **Phase 2: the growing phase**

The steering committee and/or core-group should do everything within its power to attract and motivate a critical mass. This can be done by advertising in magazines about sustainable consumption and production. SCORE! also benefits of mouth-to-mouth advertising, but the steering committee can not control for this. One participant mentioned that mouth-to-mouth advertising was the way how he joined the SCORE! community.

The growing phase is an important phase in the VCoP. The steering committee and/or core-group needs to stimulate community members to participate, contribute, and cooperate. But it is also important that the focus is kept clear, and that knowledge creation can be enhanced.

- **Phase 3: the maturing phase**

If the SCORE! VCoP reaches this phase, the VCoP is doing well. This phase is the most effective phase a VCoP can be in. The community members work at optimum efficiency, and much time and money can be saved. The steering committee can loosen its strings, because community members understand what to do and what is expected from them. Nonetheless, the steering committee should adopt a monitoring role. In this way, the SCORE! community is able to act in a more spontaneous way.

The steering committee also has to make a re-evaluation of the goals of the VCoP after the project is finished. Many things could be changed during these phases, which can make it possible that the pre-defined goals have become unrealistic or out-dated.

- **Phase 4: the maintaining phase**

This is the phase SCORE! enters in April 2008. The project is finished then, which means that the budgets are gone and that project-character of the VCoP disappears. The steering committee made clear that it is important that the community still has a place to be together. Besides focussing on the network, the VCoP must have a clear goal, in order to keep it interesting to visit in the future.

This means that a core-group is still needed. Because the project is finished, the core-group might change. It is important that the VCoP is filled with current issues about its domain. It is also fruitful to set up news letters, in order to keep community members who are in the network aware of the SCORE! VCoP. When stimulating articles are posted and communicated to the community members, the VCoP might be used a long time after the official end. Furthermore, it is important to preserve the moderator of the VCoP. The VCoP should stay clean and attractive to the people who visit it.

When this phase turns out well, the SCORE! VCoP can go back to phase two or phase three. Nevertheless, there is a great change that the SCORE! VCoP moves towards phase five.

- **Phase 5: the transformation phase**

  It is difficult to say how the SCORE! VCoP should manifest itself in this phase. It is at least essential in this phase to attract new community members. There should also be started initiatives to transport the VCoP back to phase two (i.e. the growing phase). This can for example be done by starting new projects or to shift the focus of the VCoP into another direction. Community members that are active in this phase should concentrate their energy on this.

  When this phase is successful, the SCORE! VCoP can go back to phase two or phase three. However, when things are not workable anymore, the VCoP leads towards closure.

6.2 Advice for the SCORE! VCoP

In this paragraph, some practical advice is given what SCORE! needs to take into account during working with a VCoP.
The moment the VCoP is introduced, communication becomes an essential part. If a VCoP facilitator is attained, this person could do that. If not, the steering committee needs to take care of this. Community members need to be informed about when the VCoP is launched, where they can reach it, what the rules are, but moreover what the goal and purpose are, and what is expected from them to deliver. It is important that the steering committee identifies the future goals of the VCoP too (i.e. the goals after the official end of the project).

The future goals of the SCORE! VCoP deal with the fact that the SCORE! project ends in 2008. Besides identifying the goals, it is advised that the steering committee finds new ways to generate income. This is necessary, because the funding from the European Union stops, but the VCoP will still make some costs (e.g. administration).

Income can be gathered in several ways. One way is to find sponsors who want to invest in the SCORE! VCoP. Two SCORE! members attributed their idea during the interview. One of the members proposed the idea to get funds from the FP7. According to this participant:

"There is a need for something like SCORE! in the FP7, why do we not supply it?"

Another participant postulated the idea to involve universities in the SCORE! project. Universities are a good source for funding, because it often has budgets for research programs. This could even lead to a nice exchange of information and people. When SCORE! receives funds from universities, the students from those universities could be given a role in the SCORE! VCoP. In this way a critical mass can be maintained. However, the students should not be able to post any kind of material on the VCoP. The content of the VCoP needs to be pure, which means that posted material and discussions should be relevant to the goals of the second beginning of the SCORE! VCoP. Moreover, involving universities has another benefit as well:

"Spreading knowledge is done at schools and universities"

As stated before, the steering committee needs to take an active role in the VCoP. It has to fill it in and contribute to it regularly (e.g. by filling in a monthly web log), otherwise the VCoP probably fails. This is just what happened with the SCORE! discussion forum. Because there was no activity, community members did not use it. If the steering committee has somehow no time for this, it needs to find a group of motivated members (i.e. core-group) which could take this task upon them.

It is also desirable that the steering committee creates an atmosphere that promotes community members to present their information to others. A great barrier in this is that community members might be anxious to post, because they consider themselves as not being capable enough, or they are afraid to mislead fellow community members when they post something they are not complete sure about (Ardichvili et al., 2003). This was also attributed by a SCORE! participant during the interviews. In order to lower the chances that this happens, it is advised to insert systematic processes. This means that certain tasks need to be finished by community members on a regular basis. Not only decreases this the barrier for not contributing, according to Carotenuto et al. (1999) it furthermore reduces the fear community members may have of the unknown, and VCoP usage will be embedded in the member's system (i.e. daily practice).

If maintaining the VCoP becomes a too demanding task for the steering committee after the project has finished, it is fruitful to look for partners to start up new, related projects. In that way, not only the VCoP related tasks can be boarded out, also new impulses to the VCoP can be given.

When introducing a VCoP it does not mean that physical contact is not important anymore. The SCORE! members, but also the respondents from the survey indicated that physical meetings are key factor for the success of a VCoP for European research project. However, the frequency of physical contacts can be lessened. Moreover, according to Hildreth et al. (2000) physical meetings can give the VCoP a real identity. Walsh and Maloney (2007) furthermore state that the norms of the VCoP get established by meeting each other physically. The physical meetings that will follow should also contribute to the things that are done within the VCoP. During workshops there could be discussed about materials which are created in the VCoP for example. A good combination between physical and online meetings is desirable. One thing that could enhance awareness of each other in the VCoP is by showing which members are online (i.e. online presence).

A suggestion to the physical meetings when the project is finished, is that it should be context specific. The SCORE! meetings that are initiated than should not be 'SCORE! meetings', but 'SCORE! meetings about a certain issue'. To give an example, after the SCORE! project is finished, the first issue that is treated is food. This means that discussions in the VCoP are about food, and that there is organized a work shop or conference about food. In the following year the issue could be mobility, and so on.

It is important to address the other issues in the VCoP as well, because that is one of the reasons why SCORE! is successful. It will keep those community members interested in the VCoP who are only interested in one specific field. However, when focussing on one special topic, much more can be achieved and more people are tempted to become a (temporarily) member of the SCORE! VCoP.

To conclude this chapter, the cards SCORE! hold towards becoming a successful VCoP are good. It is a great advantage that the SCORE! members know each other before engaging in the VCoP. This means that when the steering committee invests its time in the VCoP and makes participating in the VCoP a meaningful activity for the community members, the VCoP will become a success.

7 CONCLUSIONS AND RECCOMENDATIONS

Knowledge comes, but wisdom lingers (Lord Alfred Tennyson)

In this chapter, the conclusions and recommendations are given considering VCoP usage for European research projects. Also the research question formulated in the first chapter is answered.

7.1 Conclusions

In this paragraph, the main research question is answered. However, the conclusions about other issues attributed in this thesis report are highlighted as well.

In chapter two, a definition about VCoPs is given. Because this thesis deals with VCoPs for European research project the definition of such a VCoP is articulated as follows:

A virtual community or practice for European research projects is an aggregation of (self-)selected project partners who participate in a collection of activities which are related to the research project. The project partners function as an interdependent network (at least) during the timeframe of the research project. The interaction is at least partially supported and/or mediated by technology, and the research partners have the shared goals of bringing the research project to a successful end in an effective and efficient way, and further the practice in the specific research domain, which is supported by protocols and norms.

VCoPs for European research projects are only useful when researchers themselves see value in such a thing. Fortunately, almost all researchers that participated in interviews and surveys stated that a VCoP will have added value to European research projects. A large percentage also thinks that setting up such a VCoP is realistic. The question remains if people are going to use it when it is there. Over two-thirds of the researchers think that project partners will use the VCoP once it is there. It can therefore be concluded that researchers are positive about VCoPs for European research projects.

Now it is time to answer the main research question. The main research question was stated as follows:

Which factors determine the success of a virtual community of practice for European research projects?

Twenty-nine factors were assessed by researchers from TNO. From these factors, eight could be identified as critical success factors. These success factors are:

- Better availability of knowledge
- Being constantly up-to-date
- Quicker problem solving
- Reducing time and costs
- More possibilities to learn
- Physical meetings
- Characteristics of the VCoP
- Better project management

The success factors described on the page above are all applied to the VCoP factor model, which was one of the primary objectives of this thesis. In this model the factors are carefully explained. When taking these factors in account, a serious step is taken to make the VCoP a successful one. However, the factors that were rated as slightly important should still be considered. These factors do not explain the VCoP success, but when leaving them unnoticed it might influence the VCoP negatively.

The other primary objective was to create a VCoP process model. This model describes which stages need to be carried out, in order to set up a VCoP for a European research project. The process model furthermore uses the phases from the VCoP lifecycle of Wenger et al. (2002) as a guide. In total, nine stages could be identified which explain the process of initiating the idea to form a VCoP to actually launch it. These stages are:

- The identification stage
- The inspection stage
- The decision stage
- The conceptual design stage
- The prototyping stage
- The pre-launch stage
- The formative evaluation stage
- The launch and establishment stage
- The summative evaluation stage

To finish this paragraph, some people asked during the interviews what the difference is between a VCoP and a standard web site which is often used for a research project. The answer to this is that a web site is often a static virtual space on the internet where people store and download documents and look for project related information. A VCoP on the other hand also provides this functionality, but it is enhanced with discussion, conversation and cooperation tools. In stead of a virtual space, a VCoP can be seen as a virtual place. According to McDermott (2000), in order to create a sense of community, members need not only to share information amongst each other, but must communicate with each other as well. An important means of synchronous communicating in a VCoP is video conferencing. This should at least be included. Web logs on the other hand provide excellent means for a-synchronous discussion.

7.2 Recommendations

This paragraph deals with the recommendations which can be made according to the research results gathered from this thesis.

- **Keep the eight critical success factors in mind**

When a VCoP is going to be developed, the eight success factors need to be taken in mind. These success factors make the difference for a VCoP to become successful or not. Also the factors which were determined to be less important need to be taken into account. These factors do not enhance VCoP success, but could negatively influence VCoP success when left unnoticed.

- **Make the VCoP an integral part of the research project**

When a VCoP is developed for a European research project, it is recommended to make the VCoP an integral part of the research project. In that way people need to use the VCoP, which makes its purpose clear. When not doing this, but to make the VCoP as something which is also there, it will not be used. Furthermore, when using the VCoP while focussing on the project, it does not become just another source of information.

- **Design the VCoP by using a top-down approach**

When creating a VCoP for a European research project, it needs to be designed top-down. The steering committee has to define the goals and purposes of the VCoP. This is very important, because otherwise the people that are needed to become part of the VCoP will not see its value and will not join in. It is also important to focus the VCoP on the needs of the community members. They are the ones that need to use the VCoP, which means that the VCoP should be created specifically for them.

- **Preserve physical meetings when initiating a VCoP**

Even tough 'physical meetings' is a success factor, it is addressed as an individual recommendation as well. When initiating a VCoP for European research projects, one must not think that everything can take place virtual. It is still important to have physical meetings. Therefore it is recommended to organize physical meetings on a frequent basis (e.g. once a year). Physical meetings can enhance trust in the community (Ridings et al., 2002), and can act as a motivation, in order to work with each other virtual. However, the frequency can be reduced. This will save a significant amount of time and money, especially in smaller research projects. In that way European funding can be better spend instead of on too many jaunts.

- **Protect quality of information in a VCoP**

When wanting to preserve to quality of information, the goals and purpose of the VCoP should be communicated clearly. It is also advised to integrate registering and a rating system. When people are registered they will not put all kinds of information on the VCoP. When community members can rate each others contribution there is a pre-selection made of what information is the most valuable. Besides that, the purity of information is important, in order to maintain the focus of the VCoP.

- **Make a clear division of tasks in the VCoP**

It can be concluded that there need to be divided some roles within the VCoP. The steering committee and/or the core-group should pull the community to work with the VCoP. This means that it needs to motivate the community members to do so. Also a VCoP facilitator and VCoP moderator are needed, in order to guide the community members. It is furthermore important that community members understand the role they are playing in the VCoP as well. This should be communicated by the steering committee.

- **Use small groups in VCoPs for cooperating activities**

When cooperation is essential in the VCoP, it can best be done with small groups. The VCoP needs to be of good quality, and good quality is easier gained in smaller communities. When the VCoP consists of many members, it is advised to make use of sub-communities. In that way things can be easier controlled (e.g. protecting information), and information overload can be avoided. Moreover, large VCoPs are often used for the means of networking. These kinds of VCoPs could be very useful after the research project is finished. Nevertheless, it depends on the goals of the second beginning. It can furthermore be concluded that it is worthwhile to maintain VCoPs after the project has finished. In that way people are still able to find each other and to go on fruitful collaborations, or even to keep the current VCoP active by still providing contributions to it.

- **Align VCoP tasks to the daily practices of its members**

The distance between project partners becomes smaller when a VCoP is used for European research projects. However, a VCoP should stand close to the way people are working in their daily practices. A prerequisite is that the VCoP should be easy accessible and user friendly. The VCoP should lighten the job, not making it more difficult. Because people have different working habits, it is also recommendable in some cases that people have their own personalized work space (Schraefel et al., 2000). This means that the VCoP should be flexible and easily manipulated by community members. Simplicity is the key for VCoPs to become potential successful.

- **Use technology that is available to set up a VCoP**

The VCoP process model thinks of a VCoP as one completely integrated virtual space on the internet. However, when there are no funds or time to initiate a VCoP like this, for example in smaller research projects, there are some other options that might be considered. It is advisable to use technology that is already available. If the organization can not provide tools, and there is no budget, it is recommended to use file sharing tools, or other free-to-use tools. In this way, community members are still able to share their files on one place and are able to communicate with each other. Moreover, it can be questioned if a completely integrated VCoP is really necessary for smaller research projects.

- **Ask people if they want to help set up a VCoP**

When wanting to set up a completely integrated VCoP, it is recommended to first ask within the community if some would like to put their energy in the creation process of the VCoP. About one-third of the respondents of the digital survey indicated that they would like to do so. When people within the own community want to do this, possible costs can be saved.

- **Do not integrate all kinds of communication tools in a VCoP**

It is recommendable to not integrate all kinds of communication tools in a VCoP. Instead, let people use the tools they are already used to. Often these tools are free to use, and they work quite well (e.g. Skype). In this way people do not have to learn new things, and the VCoP does not have to be integrated with too many tools, which keeps it more convenient.

- **Invest time and money in a VCoP**

A vulnerable point of VCoPs is the lack of budgets (Wenger & Snyder, 2000). The steering committee must invest their time, but also their money in the VCoP (process) in order to let it reach its full potential.

- **Adopt a user-centered design approach**

When setting up a VCoP, a user-centered design approach should be followed. It is important to invite the actual users of the VCoP in all stages of the process model. When a user-centered design approach is taken, the VCoP becomes less likely to fail.

- **Evaluate the VCoP on a continuous basis**

The final recommendation which can be made is that a VCoP needs to be continuously evaluated. This is made clear in the VCoP process model. It is important that the needs of the community members and the goals of the VCoP are met. Moreover, when conducting regular evaluations, it is made sure that all things work properly as well. If not, some interventions should take place.

8 DISCUSSION

There must be a real and living doubt – without this all discussion is idle (Charles S. Peirce)

In this chapter, a discussion takes place about some issues that were encountered in this thesis report. Furthermore, this chapter is used to describe the possible limitations of the research that has been conducted. This paragraph concludes be presenting possibilities for future research in this area.

In the theoretical framework some differences are presented between CoPs and VCoPs. It is however difficult to make a distinction between these two concepts. Both concepts have many similarities. Nonetheless, two essential differences can not be left unnoticed. The members of a VCoP are dispersed over national or international regions, and communication often takes place by using mediated tools. In a CoP, on the other hand, members are situated in co-located places, whereby communication is often done face-to-face

In the theoretical framework, it is also attributed that VCoPs are informally bound. However, according to the researcher, VCoPs can be formally bound as well. It is possible that companies or organizations introduce a VCoP for projects and the like. They might also pay their employees to use them. This is however not addressed in current literature about CoPs and VCoPs. Moreover, when VCoPs are applied to the overall goals of a research project, VCoP usage is somewhat forced. Although the informal character of VCoPs is very important, not all VCoPs will, or can be completely informal.

The advantages of VCoPs are that they are often self-directed and self-motivated. This is especially so, when research projects have ended. Nevertheless, these advantages are also a drawback. When there are not enough motivated people to contribute to the VCoP, it may easily die out. Another drawback of a VCoP can be that it is hard to quantify the return of investment, because of the informal character VCoPs often have.

Another point of discussion is that 'characteristics of the VCoP' is a critical success factor. This is collectively agreed upon by the respondents of the digital survey. However, Wenger et al. (2005) stated that technology itself will not make a VCoP successful. This means that technology can only be seen as a success factor, when the other success factors are taken into account as well. Having a good technology structure and appropriate tools alone is not enough.

Based on the interviews with the SCORE! community and the results of the digital survey, two remarkable differences came above the surface. The SCORE! community find it important to get rewards when working in a VCoP. However, the results of the digital survey made clear that the factor 'rewards' is seen as a factor of non-importance.

Also networking was seen as a major activity for the SCORE! members in a VCoP. This factor was only rated 'slightly important' in the survey. Because SCORE! is a networked project this could be explained. Based on these findings it can be concluded that there might be differences between different research groups. It can be assumed that there are for instance differences between European research projects that focus on social issues compared to projects that focus on technical issues.

A final point of discussion is that the researcher used the VCoP lifecycle of Wenger et al. (2002a) from the beginning on, in order to describe the phase SCORE! is in. This is done, because the VCoP needed to be developed from scratch. However, the VCoP lifecycle can also be read as a community that tries to become a CoP. The researcher omitted this, because the focus of this thesis was on VCoPs.

8.1 Limitations

In this section the possible limitations of the conducted research are presented.

Because current literature has a limited focus on VCoP for European research projects, this thesis has been set up as a broad explorative study. Because of the broadness of the study many issues related to the subject could be captured. However, the profundity might be lacking because of this approach. There was for example not sufficient time to conduct case studies, which might have given useful and practical information that could be very valuable for this thesis. Despite this, many useful recommendations could be given.

When taking a critical look at the results from the digital survey, it can be presumed that the respondents filled in this questionnaire with having in mind that the VCoP is fully developed and that it operates in full glory. This gives however no hard evidence when the factors are important. Are they important in all phases, or only in the phase when it is working properly? Nevertheless, this problem is tried to be grasped by including those questions in the cluster experiment (i.e. hypothesis two). However, more proof is needed to make hard conclusions and to theoretically accept this hypothesis. This also counts for hypothesis one.

The results of the digital survey might also be biased a bit, because the researchers who filled in the questionnaire might have a more technical background than other researchers. Also the number of factors that needed to be rated can form a limitation. The researcher wanted to provide a complete list of factors. This resulted in a total of twenty-nine factors. Because of this large number of factors, it was difficult for the respondents to come up with factors that they found important themselves.

There could be some limitations considering the number of participants used for the interview and survey in Paris. Only eight people could be interviewed. The results that were gathered from these interviews provided excellent insights, but the results differed in some respects from participant to participant. Because the interviews could last a maximum of twenty minutes, in-depth questions could not always been asked. The selection process could be biased as well, because the participants who liked the subject of the interview might easier say ‘yes’, than those who where not interested. This could make the results skewed towards a more positive way.

The eighteen filled-in questionnaires provided good insights, but the results from only eighteen questionnaires do not provide hard evidence. The constructs from the UTAUT model could not be adequately tested with the variables that can influence them. The researcher often had to made decisions on behalf of the data gathered, which could bias the results in a way. Another limitation of the survey can be the results. Many respondents were neutral to a lot of statements. This is probably due to difficult perceptions of what the SCORE! VCoP would look like, and where it could be used for. Perhaps the abstract term ‘virtual community’ was too difficult to grasp for the respondents.

Time constraints can be seen as the final limitation in this thesis. It was not possible to actually test the proposed VCoP process model. The VCoP process model describes an ideal situation. Because it is not tested it can not be said if this model is realistic and feasible. The VCoP process model is however filled in according to the SCORE! case to give a practical example how to use the model, but also to give clear recommendations for SCORE! how to set up a VCoP. The project managers of SCORE! were looking for some practical advice. That is also a reason why this is recorded in this report. The VCoP is set up in the end of the timeframe of this thesis. The description and the results of all processes could therefore not be included.

8.2 Future research

The final paragraph of this chapter and this thesis report presents recommendations for future research.

Literature about VCoPs often takes a business, or educational perspective. It would be worthwhile to study this phenomenon from research project perspectives as well. There are currently many European projects initiated. These projects always have some barriers (e.g. distance). These barriers can be partly overcome by having a good technical environment in the form of a VCoP. This study tried to grasp the problem how such a VCoP could be set up, and tried to explain which factors are playing an import part, in order to make such VCoPs successful. However, more research in this area is needed.

This research is conducted in a European research setting. It is not sure if the results and recommendations could be generalized to another setting (e.g. Asian and American). Researchers from these continents may have many cultural differences compared to researchers from Europe, whereas the Asians might be more collective oriented and the Americans are more individualistic oriented.

The participants and respondents in this study all worked for a non-profit, research organization. Studies that focus on VCoP usage in profit organizations could be worthwhile also. Different factors might influence successful VCoP usage.

The target group in this thesis considering the practical part (i.e. the SCORE! project) is researchers in the area of sustainable consumption and production. The researcher also conducted two interviews with researchers from a more technology oriented area and a survey with all kinds of researchers. There could be noticed some differences in VCoP perceptions between the different kinds of researchers. Therefore it would be valuable to do research on different kinds of research groups. This research can also be expanded by investigating different kinds of European research projects (e.g. technical versus social research projects). Are VCoPs feasible in all kinds of European research projects, or only in a selective group of projects?

A question that rose during writing this thesis report was if the factors that are important to a VCoP for European research projects during the project would be the same when the VCoP continues after the project is finished. Would only the goals and purpose of the VCoP change, or do the success factors change with them as well? This is also a nice lead to conduct some additional research about this phenomenon.

The VCoP process model, which is actually a hypothesis model, should be tested to find out if it really works. It could for example be validated by doing a longitudinal study of cases. Besides assessing the VCoP process model, the success factors could be understood more clearly as well.

During this thesis, the wish to have a video conferencing tool which provides desktop sharing and the ability to work in documents (e.g. Word and PowerPoint files) together at the same time was often attributed. However, such a tool is not yet available. This might be a chance for software developers to jump into this need.

To conclude, the future of information exchange may lie in 3D internet. It would be worthwhile to investigate if (European) research projects could function in such a way. 3D internet can be used for discussion, to give seminars, to test products, and many more. The possibilities are unknown with 3D internet.

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APPENDIXES

APPENDIX I: DESIGN GUIDELINES

In this Appendix section some guidelines are presented which are commonly used for building web sites. Although a process model of how to develop a successful VCoP is created in chapter five, it is also necessary to understand the basic guidelines for web development. A VCoP is at least some sort of web site. The guidelines are briefly explained.

The guidelines are adopted from the following authors: Nielsen (1994); Fogg (2003); Quesenbery (2003); and Stone et al. (2005), and from one source: the World Wide Web Consortium (further referred to as W3C), an organization that develops international standards for the World Wide Web.

First, the ten guidelines from Nielsen (1994) are presented. Although the guidelines are over ten years old, they are still meaningful. The guidelines of Nielsen (1994) are general in nature. His guidelines are presented in underlying box.

1. **Visibility of system status** (the system should inform the user what is going on by giving suitable, timely feedback)
2. **Match between system and the real world** (the system should speak the user's language and appeal natural in stead of system-like)
3. **User control and freedom** (users should be able to leave unwanted states quickly, and easily)
4. **Consistency and standards** (platform conventions should be followed)
5. **Error prevention** (prevent errors at all time)
6. **Recognition rather than recall** (object, actions, and options should made visible. This reduces user's memory load)
7. **Flexibility and efficiency of use** (users should be allowed to tailor frequent actions)
8. **Aesthetics and minimalist design** (irrelevant or unwanted information should be excluded from the web site)
9. **Help users recognize, diagnose, and recover from errors** (error messages should be explained in simple terms, should precisely point towards the problem, and should constructively recommend a solution)
10. **Help and documentation** (the less documentation the better. However, if it is needed it should be easily found, it should focus on a users task, it should list concrete steps to solve a problem, and it should not be too large)

Fogg (2003) addresses seven design guidelines for web sites. Some of his guidelines are similar to those of Nielsen (1994), but there are also some additional ones. The guidelines of Fogg (2003) are used to enhance web credibility. He recognizes that these guidelines are not inclusive. This is mainly due to web technology, the types of people using the web, and people's experience with the web, which continue to evolve. Much is yet to be discovered. The guidelines of Fogg (2003) are presented in the box below.

1. **Design web sites to convey the real world aspect of the organizations** (use elements that highlight the brick-and-mortar level e.g. photographs and addresses)
2. **Make web sites easy to use** (all actions should be simply executed)
3. **Include markers of expertise** (authors credentials, citations, and references)
4. **Include markers of trustworthiness** (linking to outside materials and resources)
5. **Tailor the user experience** (the web site seems to acknowledge previous visits by welcoming the user with his name)
6. **Avoid overly commercial elements on a web site** (this can make a web site very confusing for a user)
7. **Avoid pitfalls of amateurism** (even small glitches in web site makes users suspicious)

Quesenbery (2003) addresses the importance of usability. She has found five dimensions which she calls 'the five E's'. The five E's are partly derived from ISO 9241. Her guidelines can be perceived as priorities that users of a system need.

1. **Effective** (completeness and accurateness of goal achievement by the users of the system)
2. **Efficient** (the speed by which goals are achieved by the user of the system)
3. **Engaging** (the level how well interaction is drawn from the user by the interface of the system and how pleasant and satisfying it is to use)
4. **Error tolerant** (the level how well the systems prevents errors to occur, and how well the system helps the users to recover from errors that do occur)
5. **Easy to learn** (the level how well the system supports initial orientation and continued learning throughout system use)

Stone et al. (2005) address, in their book about user interface design, four important design principles that always need to be kept in mind.

1. **Simplicity** (keep things as simple as possible)
2. **Structure** (organize the system in a meaningful and useful way as possible)
3. **Consistency** (uniform appearance is important. It makes the system easy to learn and remember)
4. **Tolerance** (design the system in ways that prevent the user for making errors)

The guidelines presented next are from W3C (www.w3c.org). These guidelines are international agreed on standards, and should be the basis for every web site. W3C is stressing the importance on web site accessibility for everyone. The guidelines are presented according to the four principles of W3C.

Principle 1: **content must be perceivable**
1.1 Provide text alternatives for all non-text content
1.2 Provide synchronized alternatives for multimedia
1.3 Ensure that information and structure can be separated from presentation
1.4 Make it easy to distinguish foreground information from its background

Principle 2: **interface components in the content must be operable**
2.1 Make all functionality operable via a keyboard interface
2.2 Allow users to control time limits on their reading or interaction
2.3 Allow users to avoid content that could cause seizures due to photosensitivity
2.4 Provide mechanisms to help users find content, orient themselves within it, and navigate through it
2.5 Help users avoid mistakes and make it easy to correct mistakes that do occur

Principle 3: **content and controls must be understandable**
3.1 Make text content readable and understandable
3.2 Make the placement and functionality of content predictable

Principle 4: **content should be robust enough to work with current and future user agents**
4.1 Support compatibility with current and future user agents
4.2 Ensure that content is accessible or provide an accessible alternative

The guidelines outlined above are general guidelines which are further specified into more concrete guidelines. For more information see: http://www.w3.org/TR/WCAG20/ complete.html

APPENDIX II: FACTORS THAT INFLUENCE THE SUCCESS OF VCOPS

Because there are named quite a few factors in paragraph 2.3, an overview of the factors is presented in this Appendix section (see table II.I). The factors are presented according to their place in paragraph 2.3. The factors are however not presented per challenge, because that would lead to some repeating of certain factors. Moreover, it is tried to group the factors that seem to have very much overlap. An example of this is 'increase job skills' and 'become better in job'. Because more research is needed in the field of VCoPs there is a fair chance that the factors that were found in this study are not all embracing. In total, 53 grouped factors could be identified.

Factors	Literature
Involve thought leaders and key people	McDermott (2000); Wenger and Snyder (2000); Wenger et al. (2002b)
Build personal and social relationships, social interaction, social behaviour, sociability, conversation, and interaction	Butler et al. (2002); Jones (1997); McDermott (2000); Porter (2004); Preece (2001); Saint-Onge and Wallace (2003); Wasko and Faraj (2000)
Having an active passionate core-group	McDermott (2000)
Create forums of thinking and sharing information, more room for discussion, and use it as a source for problem solving	Allen et al. (2003); Bieber et al. (2002); Hildreth et al. (2000); McDermott (2000); Preece (2004)
Build professional relationships, having great access to experts, increase access to expertise, increase access to people from the same domain, having a peer-group, research support, and being able to chat with experts	Allee (2002); Allen et al. (2003); Birnholtz (2005); Kollock (1996); Porter (2004); Ridings et al. (2002); Saint-Onge and Wallace (2003); Schunn et al. (2002); Wasko and Faraj (2000)
The volume of information	Allen et al. (2003)
The productivity of the community	Allen et al. (2003)
Keeping informed about general developments in the domain, discover trends, sense and respond to changing markets, keep up-to-date with current ideas, and stay current	Allee (2002); Ardichvili et al. (2002); Saint-Onge and Wallace (2003); Wasko and Faraj (2000)
Managing work, and help monitor progress	Ardichvili et al. (2003); Schunn et al. (2002)
Replace physical meetings, and having online meetings	Ardichvili et al. (2002); Preece and Maloney-Krichmar (2003)
Providing efficient idea exchange, exchange of services, sharing best practices, and reciprocity	Allen et al. (2003); Bieber et al. (2002); Hildreth et al. (2000); Kollock (1999); Leimeister et al. (2004); Preece (2004); Preece and Maloney-Krichmar (2003); Schraefel et al. (2000); Wasko and Faraj (2000)
Having a broad perspective, different styles, several perspectives, multiple viewpoints, different ideas, and different resources (to solve problems), answering questions, and asking questions	Allen et al. (2003); Porter (2004); Schraefel et al. (2000); Schunn et al. (2002); Wasko and Faraj (2000)
Increase knowledge and motivation to learn, learning, learning capabilities, and accelerated learning, knowledge creation	Allee (2002); Allen et al. (2003); Bieber et al. (2002); Hildreth et al. (2000); Preece (2004); Saint-Onge and Wallace (2003); Wasko and Faraj (2000)
Effectively helping others to learn, public duty, good thing to do, helping others, and help people do their job	Allee (2002); Allen et al. (2003); Wasko and Faraj (2000)

Quality of information, better knowledge, new knowledge, useful information, valuable information, reliable information, up-to-date information, and credible information	Allen et al. (2003); Ardichvili et al. (2003); Butler et al. (2002); Kollock (1999); Leimeister et al. (2004); Saint-Onge and Wallace (2003); Stuckey and Smith (2004); Wasko and Faraj (2000); Wenger et al. (2002b)
More fruitful collaboration, working on complex phenomena, shared activity, and participate in presentations	Allee (2000); Allen et al. (2003); Birnholtz (2005); Saint-Onge and Wallace (2003); Schraefel et al. (2000); Schunn et al. (2002)
Quality and speed of decision making, and increase speed of research	Saint-Onge and Wallace (2003); Schunn et al. (2002)
Jointly making clear what is happening, shared goals, well-defined objective and goals, having a clear goal	Allen et al. (2003); Beenen et al. (2004) McDermott (2000); Preece and Maloney-Krichmar (2003); Saint-Onge and Wallace (2003); Stuckey and Smith (2004)
Innovation, build on each others ideas, and having similar ideas	Allen et al. (2003); Saint-Onge and Wallace (2003); Schunn et al. (2002); Wasko and Faraj (2000)
Sub communities and their connections, sub communities around special interest topics, and make connections to other VCoPs	Allen et al. (2003); Saint-Onge and Wallace (2003)
Advancement of practice, and lifting the community to a higher level	Saint-Onge and Wallace (2003); Wasko and Faraj (2000)
Access to knowledge, access to inaccessible information, constructing a knowledge baseline, shared resources, and source of information	Allen et al. (2003); Ardichvili et al. (2003); Butler et al. (2002); Preece and Maloney-Krichmar (2003); Saint-Onge and Wallace (2003)
Build common language, methods, and models around specific competencies	Allee (2002)
Eliminate duplication effect	Saint-Onge & Wallace (2003)
Embed knowledge to a larger population, and shared public space	Allee (2002); Blanchard (2004); Jones (1997); Porter (2004); Preece and Maloney-Krichmar (2003); Ridings et al. (2002)
Retention of knowledge	Allee (2002)
Share power and influence	Allee (2002)
Stimulating, encouragement, enjoyment, excitement, challenging, and motivating	McDermott (2000); Schunn et al. (2002); Wasko and Faraj (2000); Wenger et al. (2002b)
Trust	Ardichvili et al. (2003) ; Butler et al. (2002); Jaarvenpaa and Tanriverdi (2003); Kollock (1999); Preece (2004); Ridings et al. (2002)
Identity, reputation, become visible, and having a sense of identity	Allee (2002); Ardichvili et al. (2003); Butler et al. (2002); Kollock (1996; 1999); Preece (2004); Preece and Maloney-Krichmar (2003); Wasko and Faraj (2000)
Develop individual skills and competencies, and increase individual or personal skills	Allee (2002); Porter (2004); Ridings et al. (2002); Saint-Onge and Wallace (2003)
Get something out of it, personal gain, economic benefits, promotion, raises, and bonuses	Butler et al. (2002); Porter (2004); Wasko and Faraj (2000)
Professional development, increase job skills, become better in job, work better and faster, and apply knowledge to job	Allee (2002); Allen et al. (2003); Butler et al. (2002); Saint-Onge and Wallace (2003); Schunn et al. (2002)
Effective communication	McDermott (2000)
Reduce costs	Allen et al. (2003); Porter (2004)
Reduce time	Porter (2004)
Increase flow of information	Allen et al. (2003)

Focus on topics that are important, relevant, and have value, and well defined objectives and goals	Allen et al. (2003); McDermott (2000); Wenger et al. (2002b)
Find well-respected community members to coordinate the community	McDermott (2000)
Available time to spend	Allen et al. (2003); McDermott (2000); Lai et al. (2006)
Build on core values of the organization	McDermott (2000)
Management support	Allen et al. (2003)
Technical features, capabilities, and having access to technology	Allen et al. (2003); Beenen et al. (2004); Saint-Onge and Wallace (2003)
Specific and numeric goals, systematic processes, and community rhythm	Beenen et al. (2004); Carotenuto et al. (1999); Wenger et al. (2002b)
Easiness of use, and usability	Ardichvili et al. (2003); McDermott (2000); Preece (2001)
Lower self-efficacy	Wasko and Faraj (2000)
Sense of (social) presence	Mitra & Schwartz (2001); Porter (2004); Rafaeli and Sudweeks (1997)
Face-to-face meetings	Hildreth et al. (2000); Preece and Maloney-Krichmar (2003); Walsh and Maloney (2007)
Synchronicity	Porter (2004); Schraefel et al. (2000)
A-synchronicity	Preece and Maloney-Krichmar (2003); Schraefel et al. (2000)
Accessibility, connectivity, and simplicity	Porter (2004); Saint-Onge and Wallace (2003); Schraefel et al. (2000)
Stability and security	Allen et al. (2003); Leimeister et al. (2004); Preece (2001)
Social binding, commitment, belonging, closeness, and togetherness	Ardichvili et al. (2003); Hildreth et al. (2000); Kollock (1996; 1999); McDermott (2000); Preece (2004); Preece and Maloney-Krichmar (2003); Rafaeli and Sudweeks (1997); Saint-Onge and Wallace (2003); Stuckey and Smith (2004); Wasko and Faraj (2000); Wellman and Gulia (1997); Wenger (1998); Wenger et al. (2005)

Appendix II table I: Factors that influence success in VCoPs from literature

APPENDIX III: SCORE! PROJECT TYPE

In this Appendix section, the project type of SCORE! is described according to the European Commission Sixth Framework Programme (hereafter FP6). SCORE! is funded by, and part of this programme. Therefore it makes sense to do so accordingly. First, a general description of the FP6 is given. This is followed by describing the different project types of the FP6, and it concludes by assigning SCORE! to one of these project types.

III.I European Commission Sixth Framework Programme

The mission of the FP6 is to turn European research and scientific networks and the European Union into the most competitive and dynamic knowledge-based economy of the world (European Commission [EC], 2004a).

The FP6 is an idea of the European Commission and is adopted in 2002. The overall budget is seventeen point five billion Euros. This amount represents three point four percent of the European Unions budget in 2002. Twelve billion Euros is invested in seven key areas. These key areas are: aeronautics and space; citizens and governance in a knowledge-based society; food quality and safety; genomics and biotechnology for health; global change and eco systems; life sciences; information society technologies; knowledge-based multifunctional materials and new production processes; nanotechnology and nanosciences; and sustainable development (EC, 2004a).

III.I.I Project types

With the purpose of realizing the FP6 mission in mind, different projects and actions have started. However, projects and actions may differ considerably. In this section, the different project types are described according to the terminology of the European Commission.

There are different types of projects and actions that are facilitating the FP6. The EC (2004a) calls these, 'instruments'. There are a total of five instruments (see table III.I).

Instrument	Description
Networks of Excellence (NoEs)	NoEs are designed to strengthen excellence in a particular domain. This is done by integrating a critical mass of resources and expertise in order to be a world force and have European leadership in that domain. This expertise is networked around joint activities.
Integrated Projects (IPs)	IPs are constructed in order to contribute and to increase Europe's competitiveness and to address major societal needs. It does so by generating knowledge and implementing it into priority themes using a programme approach.
Specific Targeted Research Projects (STREPs) and Specific Targeted Innovation Projects (STRIPs)	STREPs and STRIPs are multi-partner research, demonstration or innovation projects. Their scope is limited, because they usually focus on a single issue at hand. The difference between STREPs and STRIPs is that STREPs are used to implement priority thematic areas, whereas STRIPs are used to explore, validate, and disseminate new innovation concepts and methods on a European level.

Coordination Actions (CAs)	CAs is the means of promoting and supporting coordination, cooperation or networking research and innovation projects. This is done to improve the integration and coordination of European research for a predetermined period of time.
Specific Support Actions (SSAs)	SSAs are actively contributing to the FP6, are analyzing and disseminating the results, or prepare future activities in order to enable the community to achieve or define its strategic objectives

Appendix III table I: Description of FP6 instruments (EC, 2004a)

In underlying table (see table III.II) an overview is given of the different characteristics of each instrument. The characteristics range form purpose to participant size.

Instrument	Purpose and activities	Target Audience	EU Funding	Duration	Participant Size
Networks of Excellence (NoEs)	**Purpose:** Durable integration of the participant's research activities **Activities:** Integrating activities Joint research programme Spreading of excellence Management of the consortium	Research Institutes Universities Indirectly: Industry, including Small and Medium Enterprises (SMEs)	€ 4 - 15 million With an average of € 7 million	48 - 60 months	6 - 12
Integrated Projects (IPs)	**Purpose:** Ambitious objective driven research dealing with different issues through a programme approach **Activities:** Research Demonstration Training Innovation linked activities Management of the consortium	Industry, including SMEs Research institutes Universities Possibly: Potential end-users	€ 4 - 25 million With an average of € 10 million	36 - 60 months	10 - 20
Specific Targeted Research Projects (STREPs) / Specific Targeted Innovation Projects (STRIPs)	**Purpose:** Objective-driven research more limited in scope than IPs and usually focused on a single issue **Activities:** Research Demonstration Innovation linked activities Management of the consortium	Industry, including SMEs Research institutes Universities	€ 0.8 - 3 million With an average of € 1.9 million	18 - 36 months	6 - 15

Coordination Actions (CAs)	**Purpose:** Coordination, networking **Activities:** Meetings Seminars Workshops Working groups Studies Analyses Exchanges of personnel Exchange and dissemination of good practices Setting up information systems Management of the consortium	Research Institutes Universities Industry, including SMEs	€ 0.5 - 1.8 million With an average of € 1 million	18 - 36 months	13 - 26
Specific Support Actions (SSAs)	**Purpose:** Preparation of future actions, support to policy, dissemination of results **Activities:** Individual meetings Seminars Workshops Studies Publications Scientific awards and competitions Management of the consortium	Research Institutes Universities Industry, including SMEs	€ 0.03 - 1 million With an average of € 0.5 million	9 - 30 months	1 - 15

Appendix III Table II: Classification of the FP6 instruments (EC, 2004b)

III.I.II SCORE! project type

When looking at the description and the characteristics of the FP6 instruments, it can be concluded that the SCORE! project falls under Specific Support Actions (SSAs). SCORE! has the same purposes, organizes the same activities, and falls under the same target audience as summed up in table III.II. Moreover, the budget of SCORE! is one million Euros, the project is spread over thirty months, and its core-group consist out of ten people.

APPENDIX IV: RESEARCH DESIGNS

IV.I : SURVEY DESIGN (researchers)
IV.II : CLUSTER EXPERIMENT DESIGN (researchers)
IV.III : INTERVIEW DESIGN (SCORE! community)
IV.IV : SURVEY DESIGN (SCORE! community)
IV.V : FIELD TEST DESIGN (SCORE! community)
IV.VI : INTERVIEW DESIGN (researchers)

IV.I SURVEY DESIGN (researchers)

Hello,

My name is Jurjen Jansen and I am a MSc. Communication Studies student at the University of Twente. I would like to ask you, on behalf of my graduate thesis about 'virtual communities', to fill in the survey below.

The goal of the survey is to gain insights in the possible use of virtual communities for European research projects. A virtual community can be perceived as an internet application, or a tool, to make distant cooperation processes more efficient. Filling in this survey will take maximum 10 minutes of your time.

Before you start answering the questions, I would like you to read the following situation sketch.

Situation sketch: Imagine that you are taking part in a European research project which falls under the Seventh Framework Program (FP7).

During discussions with your research partners, the idea to set up a virtual community is brought forward. A virtual community can be interpreted as an internet application, or tool, to make distant cooperation processes more efficient. During the discussion, the virtual community is proposed to be a project specific meeting place on the internet. It will be a virtual project space where research partners (from all over Europe) can 'meet' with each other, in order to collaborate (e.g. on documents), to discuss (e.g. by video conferencing), to exchange knowledge, etc., without constant taking planes to meet each other physically. Of course, these physical meetings are still necessary, but could the usage of such a virtual community make the cooperation process more efficient, or could it not?

1: During the discussion above, 29 arguments are mentioned that could make the European research project more efficient and more successful when such a virtual community would be introduced. Which criteria do you consider important for such a virtual community, and which not? Please give your opinion on each argument!

	Not important	Slightly important	Very important
01. **Stimulate professional development** (think of: increase competencies; get better in job)	0	0	0
02. **Stimulate technical development** (think of: learn to better use technology (i.e. computer programs))	0	0	0
03. **Stimulate personal development** (think of: increase social skills)	0	0	0
04. **More possibilities to learn** (think of: increase knowledge; easier exchange of experiences and best practices)	0	0	0
05. **Better availability of knowledge** (think of: finding useful and qualitative information)	0	0	0
06. **Being constantly up-to-date** (think of: access to recent research; discovering trends; fast response to changing markets)	0	0	0
07. **Faster problem solving** (think of: asking and answering questions)	0	0	0
08. **Reducing time and costs** (think of: work more effective and efficient; replace physical meetings by online meetings; speeding up the research process)	0	0	0

	Not important	Slightly important	Very important
09. **Better project management** (think of: monitor the research process more easily; watching what other researchers are doing)	0	0	0
10. **Having a broad perspective** (think of: access to multiple viewpoints; access to different styles and ideas)	0	0	0
11. **More professional contacts** (think of: fast access to experts and their expertise; having a peer group)	0	0	0
12. **More possibilities for innovation** (think of: creating new knowledge faster; built on ideas of others)	0	0	0
13. **Stimulating to cooperate** (think of: better means of cooperation and learning together)	0	0	0
14. **More room for discussion** (think of: discussions about the domain; more professional interaction)	0	0	0
15. **Rewards** (think of: possibilities to publicize own research; possibilities for promotion)	0	0	0
16. **Intangible rewards** (think of: become visible in the domain faster; get a reputation/status fast)	0	0	0
17. **Moral obligation** (think of: possibilities to expand knowledge in the domain; helping other people in the domain in faster ways)	0	0	0
18. **Networking** (think of: identify important people in faster ways)	0	0	0
19. **Shared public space** (think of: spread knowledge to a large audience; one place for all knowledge)	0	0	0
20. **More room for social interaction** (think of: possibilities to socially interact with people outside own institution)	0	0	0
21. **Characteristics of the virtual community** (think of: user friendliness, accessibility, security, simplicity)	0	0	0
22. **More access to respected people** (think of: presence of key people/though leaders from the domain)	0	0	0
23. **Sub-communities** (think of: easy way of making work groups that interact around specific topics)	0	0	0
24. **Synchronicity** (think of: being able to participate in direct, online discussions with researchers from all over Europe (e.g. video/audio conferencing))	0	0	0
25. **A-synchronicity** (think of: being able to participate in indirect, online discussions with researcher partners from all over Europe (e.g. discussion forum, web log))	0	0	0
26. **Responsible members** (think of: people that lead and motivate the community. and keep the community together)	0	0	0
27. **Physical meetings** (think of: besides having online meetings only physical meetings are needed to keep people motivated to work Virtual)	0	0	0
28. **Critical mass** (think of: having enough people that keep the community interesting enough)	0	0	0
29. **Relevance** (think of: well defined goals of the community; clear focus/value/purpose)	0	0	0

2: Are there any factors that you find very important, which could make a virtual community even more successful, but which were not mentioned in the table?
If yes, please write them down in the field below.

The questionnaire concludes with some general questions

3a:	Do you think that such a virtual community can have added value within a European research project?	0 Yes | 0 No
3b:	If yes, do you think it would be realistic to set up a virtual community for a European research project?	0 Yes | 0 No 0 N/a
4:	Are you confident that people within a European research project would work with a technical tool like a virtual community?	0 Yes | 0 No
5:	Would you put energy in setting up a virtual community for a European research project?	0 Yes | 0 No
6a:	Do you have experience with virtual communities in general?	0 Yes | 0 No
6b:	If yes, how many years of experience do you have with them?	…… Years
6c:	Do you have experience with virtual communities for European research projects	0 Yes | 0 No 0 N/a
7:	What is/was your role within the virtual community you have experience with?	0 Participant 0 Manager 0 Moderator 0 Other 0 N/a
8:	Gender	0 Male 0 Female
9:	Age	…… Years

IV.II CLUSTER EXPERIMENT DESIGN (researchers)

Thank you very much for cooperating in this experiment. The results will be treated with confidence. The goal of this experiment is to find out which factors are important in a virtual community for European research projects, and when. (Ask the participant if the term virtual community is understood properly. If not, then explain it again briefly).

Questions

1. Can you name the numbers of the factors which you have rated as 'not important'? Can you describe per factor why you find that factor not important? (The factors that are rated not important are removed from the factors that are written down on the cards, which will be used for the experiment).

2. Are there any factors, which you consider important in a virtual community for European research projects, which were omitted in the questionnaire? If yes, could you write those factors down on an empty card?

3. A virtual community can have varying numbers of members. Can you assign two or three factors that you think are most important to virtual communities that have less then ten members, to virtual communities that have between ten and one hundred members, and to virtual communities that have more then one hundred members?

The three different community sizes are printed on one A4 so the participant can easily process the question.

4. According to literature virtual communities undergo a lifecycle process. The lifecycle has five phases. Can you assign two or three factors which you think are the most important to the five phases the virtual community can be in?

The five phases are printed on one A4 with a brief description so the participant can easily process the question. The descriptions of the phases are slightly enhanced in order to make it better perceivable by the participant. The five phases are: beginning phase (the virtual community is set up); growing phase (individual people within the virtual community are turning into a community. There is initiated more and more collaboration); maturing phase (the virtual community is no running more from a bottom-up approach. The community members are setting the standards and people collaborate to a full extend with each other. Also the value of the virtual community is formed); maintaining phase (the once enthusiastic community members are slightly loosing their motivation. The most important purpose is to maintain the community); and transformation phase (community members who do not see the purpose anymore are leaving the community. New people are joining the community).

Cluster experiment

What now follows is the cluster experiment. The factors that you think that have any connection have to be subdivided in clusters. When you think you can not cluster the factors any further you can stop and you have to give the clustered factors a (category) name. To give a practical example; a cluster is a school, whereas the factors are students and teachers.

Thank you for participating.

IV.III INTERVIEW DESIGN (SCORE! community)

Introduction
First of all I would like to thank you to participate in this interview. My name is Jurjen Jansen and I am a graduate student MSc. Communication Studies student at the University of Twente, the Netherlands. I am conducting a master thesis about virtual communities at TNO (Delft), which is related to the SCORE! project.

Purpose of interview and interview set up
The purpose of this interview is to understand how the SCORE! project is perceived by its community, and to find out possibilities to continue with the project after it ends in April 2008. This is also the order of the questions what will be asked during this interview. The interview will take about twenty minutes.

The two other purposes (i.e. understanding what the community thinks about starting a VCoP for SCORE! and understanding what they might need in that VCoP (i.e. needs assessment) will not be mentioned at this point in order to not influence the participant. In this way question three will not be biased.

Assure confidentiality
The results from this interview will be treated with confidence. No names will be mentioned.

Describe the selection of the participant
There are 60 people who are attending the SCORE! workshop. The participants are randomly selected from these 60 SCORE! members.

Check-up
Ask the participant if he agrees to let the interview be recorded. Then ask if he/she has any questions? If not, the interview can start.

Questions

Rationale: *The following questions will be asked to make the participant comfortable. This can be done by letting them talk about their profession first (Downs & Adrian, 2004). In this case that will be the SCORE! project. These questions are also asked to see how the participants perceive SCORE! Because it is not useful to directly ask them if they are satisfied, the answers to the following questions will lead to an indirect answer to that question. The questions are also asked to understand the motivations participants have to be part of and work for SCORE! The questions about satisfaction will trigger the participant to think about the things that are done good or bad in SCORE! These questions will prepare both the interviewer and the participant for the questions about the needs of the SCORE! community.*

1. What is your role in the SCORE! project?
    a. What kind of tasks do you perform?
    b. Do you like being part of SCORE!? If yes, can you name two reasons?
    c. What are your key-motivations to work on SCORE!?
    d. Is SCORE! flexible enough to combine it with your other priorities?
    e. How do you perceive the communication during the SCORE! project?
    f. Does SCORE! provide you adequate ways to collaborate with other members?
    g. Do you have encountered problems during SCORE!? If yes, do you have suggestions for improvement?

Rationale: *The following questions are about the web site of SCORE! It is important to understand if the SCORE! web site works properly or not. If the web site would be excellent, there might be no need to introduce a VCoP for SCORE! It is also important to understand which things do work, and which things are not working.*

2. Have you ever been on the SCORE! web site?
    a. Could you explain what works for you, and what does not?
    b. The functions of the web site (forum, search engine, registering, etc.)?
    c. The usability of the web site (navigation, finding the right information etc.)?

Rationale: *The following questions will be asked to see if the SCORE! members would bring forward the idea of introducing a VCoP themselves. It is also asked to see if the members have other creative ideas to continue with SCORE! A short introduction that SCORE! ends in April 2008 will be given in advance of these questions.*

As you might know, the SCORE! project officially ends in April 2008. The SCORE! co-ordination team is currently brainstorming how SCORE! should continue after that.

3. What do you think about the initiative to continue with SCORE!?
    a. Do you have any suggestions how SCORE! and its community should continue?
    b. What do you think about joining an existing community?
    c. What do you think about setting up an own community?

Rationale: *The following questions are asked to understand what the SCORE! members think of the idea to start a VCoP for SCORE! Also motivations to participate in such a VCoP will be asked for, to understand what triggers them. This could be helpful in setting up a VCoP for SCORE! Before these questions are asked a small introduction of the VCoP concept will be given. This makes the questions better understandable for the participant. The VCoP concept will be described as clearly as possible while leaving out the technical terms. This is done to not confuse the participants.*

The virtual community for SCORE! can be seen as a web site on which the SCORE! members can participate in a collection of activities, like discussing, working together, brainstorming, and the like. But it also can be used for the means of networking, document sharing, finding useful information, and so on. Developing this virtual community has four reasons: building the first (virtual) community (which will consist of a large network of professionals) around sustainable production; maintaining the large and active community already involved (after the end of the project); working effective and efficient on project tasks, and related tasks in the future; and make publishing of research easier.

4. What do you think about the idea to develop a virtual community for SCORE!?
    a. Do you think SCORE! is ready for such a step?
    b. Would you be willing to participate in the SCORE! virtual community?
    c. Could you name three important motivations to participate in the SCORE! virtual community?
    d. What would you like to get out of the SCORE! virtual community?
    e. What kind of tasks would you really like to perform in the SCORE! virtual community?
    f. How could working on SCORE! tasks get more effective/efficient?
    g. Do you see any barriers for this idea? How could they be overcome?
    h. Would face-to-face contact still be important when working virtual?
    i. Do you have experience with other virtual communities? If yes, which factors made the difference to continue/stop participating?

Rationale: *The following questions can be translated in a market analysis/needs assessment. When designing a VCoP it is important to not do that from a technological point of view, but from the point of view of the actual user. The things that might be brought up in question four will be left out. The following questions are particularly chosen because these tools are thought to be used most likely in a VCoP.*

5. Do you know wiki's? Do you have experience with wiki's? What is your opinion about wiki's? Do you feel a need for it in SCORE!? If yes, what would you like to do with it?

6. Do you know web logs? Do you have experience with web logs? What is your opinion about web logs? Do you feel a need for it in SCORE!? If yes, what would you like to do with it?

7. Do you have experience with synchronous communication tools (e.g. video/audio conferencing)? What is your opinion about them? Do you feel a need for them in SCORE!? If yes, what would you like to do with them? Which tool would you prefer?

8. Do you have experience with a-synchronous communication tools (e.g. discussion forum)? What is your opinion about them? Do you feel a need for them in SCORE!? If yes, what would you like to do with them?

9. What do you think of better networking software (i.e. user profiles) to identify other members? What kind of information do you find necessary and thus needs to be included?

10. Do you feel a need for a document repository where all documents related to SCORE! can be found, and where you can share your own documents?

Rationale: *The last open question of this interview is to find out if there are left out some important issues that the participant might consider important. This could provide useful and additional information.*

11. Are there any issues I should have asked you about? Is there anything you would like to add to the interview?

Thank the participant again for cooperating

IV.IV SURVEY DESIGN (SCORE! community)

Thank you for filling in this questionnaire. The goal of the questionnaire is to understand how SCORE! should continue in the future, and to discover the attitude of the SCORE! community towards technology. Filling in this questionnaire will take about 5 minutes. The results will be treated with confidence.

01 As you might know, the SCORE! project officially ends in April 2008. The co-ordination team of SCORE! is currently brainstorming about the issue how the project should continue. They would also like to hear your opinion about that. How should SCORE! and its community continue after April 2008, according to you?

A possible way to continue after April 2008 is by participating in a virtual community. A virtual community can be perceived as an internet tool where the SCORE! community can participate in a collection of activities like discussion, collaboration, brainstorming, and the like. It can also be used for the means of networking, document sharing, asking questions, finding and sharing useful information, etcetera. The following statements should be answered by filling in the option that fits your opinion best. (**VC stands for: Virtual Community**).

	Fully Disagree	Disagree	Neutral	Agree	Fully Agree	Don't Know
02 Developing a VC for SCORE! is a good idea	0	0	0	0	0	0
03 I would be motivated to use the SCORE! VC	0	0	0	0	0	0
04 Using the SCORE! VC would fit well in my style of work	0	0	0	0	0	0
05 Using the SCORE! VC would save me time	0	0	0	0	0	0
06 I would use the SCORE! VC as a source of knowledge	0	0	0	0	0	0
07 I would use the SCORE! VC for professional purposes only	0	0	0	0	0	0
08 I think that using the SCORE! VC will be easy for me	0	0	0	0	0	0
09 I would have sufficient time to use the SCORE! VC	0	0	0	0	0	0
10 Using the SCORE! VC would save me money	0	0	0	0	0	0
11 I would be happy if a VC would be developed for SCORE!	0	0	0	0	0	0
12 Using the SCORE! VC would make my work more interesting	0	0	0	0	0	0
13 Using the SCORE! VC would increase my technical skills	0	0	0	0	0	0
14 There are people, who are important to me, that would like me to use the SCORE! VC	0	0	0	0	0	0
15 I would recommend others to become part of the SCORE! VC	0	0	0	0	0	0

	Fully Disagree	Disagree	Neutral	Agree	Fully Agree	Don't Know
16 Using the SCORE! VC would increase my professional skills	0	0	0	0	0	0
17 I would not mind to voluntary participate in the SCORE! VC	0	0	0	0	0	0
18 Using the SCORE! VC would increase my personal skills	0	0	0	0	0	0
19 I would share my knowledge with other SCORE! members in the SCORE! VC	0	0	0	0	0	0
20 I would need much training in order to use the SCORE! VC	0	0	0	0	0	0
21 I would use the SCORE! VC to socially interact with other SCORE! members	0	0	0	0	0	0
22 When many SCORE! members would start using the SCORE! VC I would also start using it	0	0	0	0	0	0
23 I have no physical limitations that would influence the way I would use the SCORE! VC	0	0	0	0	0	0

24 How many years will you stay active in the field of SCORE! 0 < 1 year | 0 1-2 years | 0 3-4 years | 0 > 5 years
25 Do you have experience with virtual communities? 0 yes | 0 no
26 How many years of experience do you have with them? 0 < 1 year | 0 1-2 years | 0 3-4 years | 0 > 5 years
27 Do you still use this/these virtual community/-ies? 0 yes | 0 no | 0 not applicable
28 Which (motivational) factors made the difference for you to continue/stop participating?

29 Which (motivational) factors will make the difference for you to use, or not to use, the SCORE! VC?

30 What is your role in the project? 0 Co-ordination team | 0 SCORE! member | 0 SCORE! community | 0 other
31 Age: 0 20-29 years | 0 30-39 years | 0 40-49 years | 0 50-59 years | 0 > 60 years
32 Gender: 0 Male | 0 Female
33 Nationality: ……

Coding scheme UTAUT constructs (not visible for the respondents)
Performance expectancy: number 5, 10, 12, 13, 16 and 18; Effort expectancy: number 8 and 20; Social influence: number 14 and 22; Facilitating conditions: number 4 and 9; Behavioural intention: number 6, 7, 19 and 21; Attitude towards using technology: number 2, 3 and 11; Variables: Gender and age: number 31 and 32; Variables: Experience: number 25, 26 and 27; and Variables: Voluntariness of use: number 17.

IV.V FIELD TEST DESIGN (SCORE! community)

In section 4.5.1 there was spoken of an analysis framework that needed to be made to analyse the video conferencing tools. Because of the small setting of the field work, the option to use the Adaptive Structuration Theory (see Appendix VI) is not feasible. The video conferencing tools will therefore be analyzed on a basic level. However, some constructs of the Adaptive Structuration Theory could be used. Besides using constructs of the Adaptive Structuration Theory from DeSanctis and Poole (1994), other constructs could be obtained from chapter two to analyse the video conferencing tools as well. Information from the following authors is used to do this: Blanchard, 2004; Chin et al., 1997; Porter, 2004; Preece, 2001; Saint-Onge and Wallace, 2003; Schunn et al., 2002; and Wenger et al., 2005.

- Can the technology be easy accessed?
- Is the technology easy to use?
- Is the technology intuitive in its use?
- How much effort does it take to understand the technology?
- Are the features of the technology named and presented well?
- Is the technology used in a proper fashion?
- How does the technology assist in the communication process?
  - Does the technology lead to good synchronous discussion?
- Does the technology allow for social communication?
  - Is the technology enabled to let users provide social cues?
  - Can the technology create a sense of social presence?
  - Can the technology create a sense of togetherness?
  - Can the technology create a sense of place?
- Is the technology qualitatively good?
  - Is the technology accurate?
- Is the technology useful?
- Are the objectives met by using the technology?
- Does the technology provide additional help?
- What are the pros and cons of the technology?

Before each field test, an email was sent to inform the participants. On the next page, an example of such an email is presented.

SCORE! VIDEO MEETING MAY 14TH

Dear members of the Heritage Committee of SCORE!,

As announced, we will have a SCORE! video meeting about the spin-off of SCORE! This video meeting will be held on **May 14th**, and will start at **15.00 (GMT + 01.00)**. The duration of the session is fixed and will last a maximum of one hour and a half. For this video meeting we are going to use **FlashMeeting**. FlashMeeting allows dispersed groups of people to interact with each other in a standard web browser.

The proposed **agenda** of this meeting:

- The discussion document makes some strong statements on the points of departure for organizing the spin-off (democratic, focus on quality, creating a flow of knowledge, etc. – see section 1.2).
- Articulating contents: on what topics should the flow of knowledge creation be concentrated?
- Articulating related target groups: what groups of people would we ideally like to involve?
- Are there clear missing groups in the current SCORE community, and what is our honest feeling of how many people a SCORE spin-off could enlist?
- Articulating consolidation options: what does this imply for the 6 potential consolidation options listed in Table 1.1?

The **requirements** that are needed for this session:

- Internet connection
- Adobe Flash Player 8 (or higher) plug-in*
- Microphone and speakers (or a headset)
- Webcam (optionally)

*You can check your version of the Adobe Flash Player on http://www.adobe.com/products/flash/about/. If your version is too old, or you don't have the player installed at all, you can automatically install it from this web site.

FlashMeeting sign-in account (is needed in advance of the meeting)

- Open: http://flashmeeting.open.ac.uk/fm/d6f33c-XXXX
- Click: 'click here'
- Follow the steps and you will get an account

Logging on to the meeting:

- Open: http://flashmeeting.open.ac.uk/fm/d6f33c-XXXX
- **Click this link preferably 10 minutes before the meeting start!**
- Click: 'go to the meeting'
- A pop-up appears, choose: 'allow'
- Fill in your email address and password (from FlashMeeting sign-in account)
- Check the radio button: 'enter meeting signed in' and click: 'continue'
- Test your equipment by clicking: 'open test application' and follow the steps
- When returning: enter your name, agree to the terms, and click: 'enter'*
- Now you are in the meeting!

*If you are signing in before the meeting will start, you can not go further than the title screen. The timer will show how long you have to wait

Please make sure that your hardware devices are working before the meeting starts, and that you have a FlashMeeting sign-in account!

Kind regards, Jurjen Jansen (SCORE! - Graduate Student)

IV.VI INTERVIEW DESIGN (researchers)

First of all I would like to thank you for your time to do this interview with me. My name is Jurjen Jansen and I am a graduate student MSc. Communication Studies at the University of Twente. I am conducting a master thesis about VCoPs for European research projects. A colleague mentioned that you have some experience with such kinds of virtual communities. The purpose of this interview is to gain some practical insights in the usage of VCoPs for European research projects.

Questions

1. What is your interpretation of virtual communities?

2. Can you describe for what kind of project the virtual community is used?
   a. How many community members are involved in the project
   b. What kind of people are they?
   c. What is your own background?
   d. Can there be noticed any differences in virtual community usage between the different members?

3. How is your virtual community set up?
   a. How was this achieved?
      i. Did you make use of any kind of guidelines?
   b. What kinds of tools are integrated in the virtual community?
      ii. Do these tools provide added value?
      iii. Are these tools sufficiently used?
      iv. What kind of tools work and which do not?
      v. What kind of tools need to be at least integrated in a virtual community for European research projects?

4. What are your experiences with virtual communities for European research projects?
   a. Does real cooperation take place in the virtual community?
   b. Are community members motivated to work in a virtual community? If yes, how is this motivation achieved?
   c. In the SCORE! project, money and rewards are motivating factors to contribute to the virtual community. Is this also the case in the virtual community you are part of?

5. European research projects often have a limited time-span. Is there an option that your virtual community will continue after the project, where the virtual community is initiated for officially, ends?
   a. If yes, do you have any idea how your project will continue?
      vi. Is finance needed when continuing with the virtual community?
      vii. Do community members stay involved when the virtual community continues to exist?

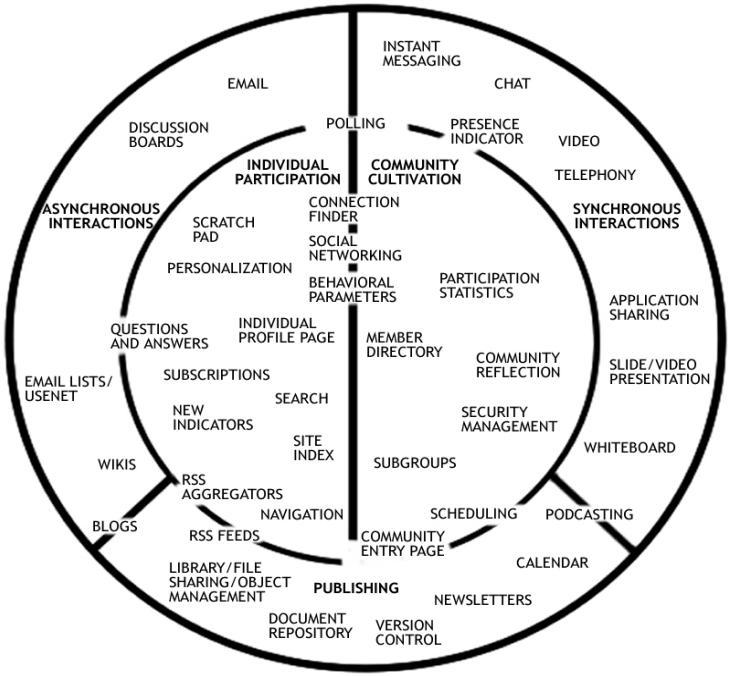
6. Is there anything that you would like to add to this interview?

Thank you for your cooperation

APPENDIX V: TOOL SELECTION

The goal of this Appendix section is to sum up various mediated tools that can be used to facilitate VCoPs. In this Appendix section an answer to sub question six *(i.e. which tools are available, and can be integrated in a virtual community of practice?)* is given.

According to Wenger et al. (2005) there are three broad tool characteristics that can be used for VCoPs. The first characteristic is interacting. These are tools that can be used for discussion, brainstorming, collaborative work, and the like. Publishing is the second characteristic. These tools are used to produce, share, and collect relevant artefacts. The third characteristic is tending. With these tools, members can nurture their togetherness. In underlying figure (see figure V.I) all kinds of community tools are inventoried. Figure V.I has five regions. In the outer band the tools are described according to asynchronous interaction, synchronous interaction, and publishing activities. In the inner band, the tools are described for community building activities. In the inner band a distinction is made between individual participation and community cultivation (Wenger et al., 2005).



Appendix V figure I: Community tools in a complex landscape of activities (Wenger et al., 2005)

As one may notice, there are a lot of different tools available. The tools that are described in this section are tools that fall under the outer band of the figure. One tool (i.e. social network services) that is also described falls however within the inner band of the figure.

The tools are be described are often called 'social software'. Social software can be defined as *"all software which aims to simplify the construction and maintenance of networks of people",* my translation from the Dutch (Fontys Hogescholen [FH], 2006, p. 4). With social software, 'social computing' is enhanced. Social computing is social behaviour displayed in computational environments. Social computing can be sharing documents, but social support and facilitation play a more important part.

Various mediated tools allow community members to work together in VCoPs. They are not only communicating online, but they are also constructing a (collaborative) knowledge-base (Bieber et al., 2002). However, the authors are somewhat concerned with the current generation of collaborative tools. The tools available today can not be used in a proper fashion when there are over 50 participants participating at the same time. An important requirement to work online is that people must have the same communication tool available.

Cultivating a VCoP is often done by one person, but sometimes by a small group (Wenger et al., 2005). Tending to the technology (i.e. the third characteristic) is very important for VCoPs that are depending on technology. Wenger et al. (2005) call the people responsible for this, 'technology stewards' (i.e. moderators). These so-called technology stewards have three important roles. Technology stewards first need to understand the evolving and exploding market of relevant technologies, because they can provide new resource for the community. The second role is to see the technology market from the perspective of a living community. This is important, in order to select technology that fits the specific activities inside the community. The third role is to support the way community members use or do not use the provided technology.

In a VCoP there are broadly two types of tool categories, push tools and pull tools. Knowledge libraries, workshop modules, and news are forms of push tools. These kinds of tools are not described here. Pull tools include features where members can directly work with (e.g. discussion forums; chat rooms; and live meetings). These tools encourage people to participate and collaborate in VCoPs (Kondratova & Goldfarb, 2004).

When choosing a good tool for communication, the goal of the communication task should be clear. Preece and Maloney-Krichmar (2003) are mentioning in their article that physical contact is not really necessary for all types of communication. And that this also counts for high-bandwidth synchronous environments. For example, voice conferencing is adequate enough for information transfer tasks; text is adequate when the content may be embarrassing; and asynchronous textual communication is adequate when people are in geographically dispersed locations. This means that sophisticated technology is not always needed. Saint-Onge and Wallace (2003) make clear that technology, which supports the community, should integrate social aspects at the lowest bandwidth possible.

The following software is explained in this appendix section: synchronous communication tools (i.e. text-based chat; voice conferencing; and video conferencing); discussion forums; web logs; podcasts; wiki's; collaborative real-time editing (i.e. whiteboards and desktop sharing); virtual worlds; file sharing systems; social network services; and RSS. The tools are described in general, and examples of related applications that could be used for a VCoP are presented.

Because there is such a wide-range of mediated communication tools, some selection criteria is needed. There are two main criteria where the tools are selected on. The first criterion is usability. The tools need to be easy to use. This means that community members should not install all kinds of software, but just start and working with a programme by a few clicks on the mouse (preferably web-based tools). The second criterion is that the tools should be low on costs or for free. This is necessary, because there is often a limited budget for (European) research projects. One final criterion, which is not always applicable, is that the tool should be easily integrated in a VCoP. For this reason, not all tools are integrated in this Appendix.

To find applications that fit the criteria, the search engine of Google (www.google.com) was used. In some cases, several web sites that provided a long-list of applications were found (e.g. http://wikipedia.org). These lists provided overviews of what kind of applications are out there. A few other examples are: www.wikimatrix.org for wiki applications; www.kolabora.com to find collaborative technologies; and www.neobinaries.com for Web 2.0 applications. The most promising applications which sufficed the self-formulated criteria were selected.

V.I Synchronous communication tools

Most of the time, synchronous communication tools are used in a text-based form and takes place one-to-one. However, with new techniques communication can also be many-to-many, and can be facilitated with audio (i.e. VoIP) and video. The communication tools that fall under this category and which are going to be described here are: text-based chat; audio conferencing; and video conferencing. A downside of synchronous communication is that content is only developing during the sessions.

V.I.I Text-based chat

Text-based chat tools allow people to communicate with one another via typed text. The most popular text-based chat tools used to be IRC (Internet Relay Chat) and ICQ (which is pronounced as: I seek you). Today MSN (The Microsoft Network) Messenger is the most popular chat application, which is recently called Windows Live Messenger. Modern text-based chat applications have the advantage that people are also able to communicate with each other via audio and video.

Text-based chat tools are an excellent tool for social communication. However, non-verbal cues (e.g. tone of voice; body language; and facial expressions) are missing. Emoticons are trying to compensate for this, but it is still not the same. Due to this, a sense of social presence, empathy, and trust are harder to develop (Preece & Maloney-Krichmar, 2003). Text-based chat can also be used for discussions with a more businesslike character. However, this is not always very practical. When there are many people participating, the discussion can become very inconvenient. The order can be messed up, and the discussion may turn into frustration. People need to be very alert to what is said. The chat sessions are often recorded in a log-file, but it can be very time consuming to find the things are needed.

Besides stand-alone text-based chat tools, there are also chat tools that can be integrated into a VCoP. Two chat tools that matched the criteria and are found to be reliable are FlashChat and PHP Free Chat.

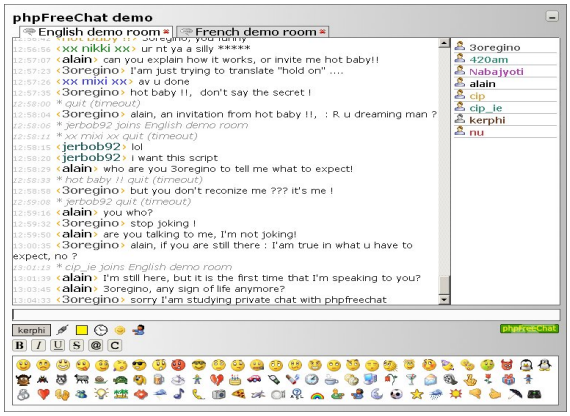
- FlashChat

FlashChat is a chat environment which is easily integrated in a VCoP. This service is reasonably priced. It can be purchased for only five Dollars. Some of its features are: advanced administrative options; highly configurable; support of twenty languages; advanced installation wizard; and bad word filter. Web site: www.tufat.com/s_flash_chat_chatroom.htm.

- PHP Free Chat

PHP Free Chat is a chat environment which is easily integrated in a VCoP as well. PHP Free Chat is open source software and can be used for free. Some of its features are: support all languages; does not need MySQL or SQL databases; highly configurable; and emoticons. Web site: www.phpfreechat.net.

Appendix V figure II: FlashChat (www.tufat.com/s_flash_chat_chatroom.htm)



Appendix V figure III: PHP Free Chat (www.phpfreechat.net)

V.I.II Audio conferencing

Audio conferencing allows people to talk to each other over the internet. The best known application in this area is Skype. With this tool people can make free calls over the internet. Another well-known application, especially in the world of games, is TeamSpeak. Requirements for these kinds of applications are a microphone for audio input, and speakers for audio output. A headset which includes both requirements is often used for audio conferencing.

Audio conferencing adds a social cue with respect to text-based chat. People often find it more personal to communicate with others by speech. If there needs to be arranged something quickly, audio conferencing is a better solution than text-based chat. Advantages of VoIP communication is that costs of (long-distance) calls are saved. A downside of audio conferencing is that the other party needs to be available at the same time (Walsh & Maloney, 2007).

In this section, the two above mentioned applications are described, because they best fit the criteria.

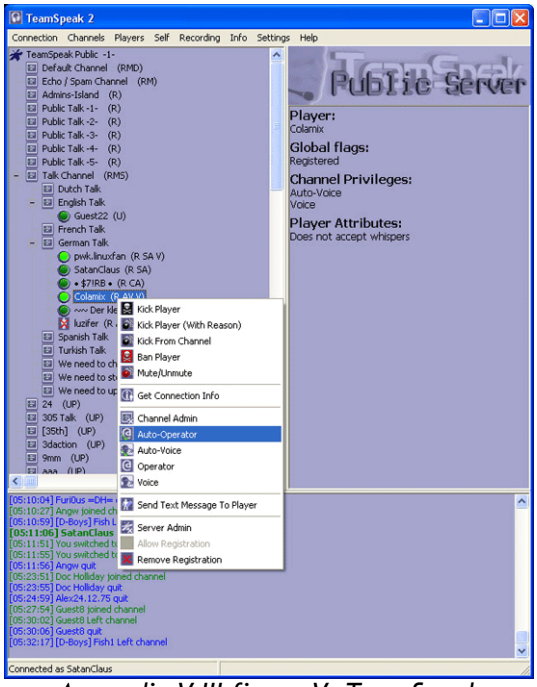
❖ Skype

Skype is a voice conferencing application that allows its users to make free calls to other Skype users. It does not matter where people are located, as long there is an internet connection and Skype is installed, people can use it. Skype is free to use and allows a web cam to the conversation, which means that people can see each other. Skype is normally used for one-on-one conversations, but it can also host a meeting up to four participants. Skype is a stand-alone application, which means that it can not be integrated in a VCoP. Some of its features are: high quality output; chat; and document sharing. With Skype, calls to fixed and mobile telephones can be realized as well. Unfortunately, this feature costs money. For more information on Skype, see www.skype.com.

❖ TeamSpeak

TeamSpeak is an application used for voice communication. TeamSpeak does not run on a peer-to-peer basis, but on a dedicated server. This means that TeamSpeak can literally handle thousands of users simultaneously, which is a good requirement for internet-based teleconferencing. A downside of TeamSpeak, which can also be derived from its name, is that it does not allow video. Some of its features are: optimal voice quality; cross-platform design; recording of sessions; chat; kicking and banning features; and easy integration in MySQL environment. Web site: www.goteamspeak.com.

Appendix V figure IV: Skype



Appendix V III figure V: TeamSpeak (www.goteamspeak.com)

V.I.III Video conferencing

Video conferencing is a means of synchronous communication with the ability to see people who are participating in the meeting. Video conferencing makes it possible for people to collaborate with other people in diverse physical locations. People can interact with each other by video and audio transmission. The requirements for video conferencing are a webcam for video input, a monitor for video output, and a microphone and speakers (e.g. a headset) for audio in- and output. Video conferencing is often used to save money and time. Nonetheless, subtle body languages and participant's moods are lost (Preece & Maloney-Krichmar, 2003).

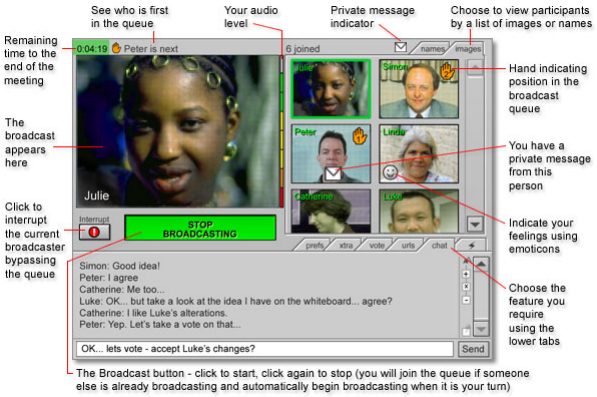
There are two types of categories in video conferencing software. The first kind is one-to-one video conferencing. This can be done by tools like MSN and Skype, which are described in the previous sections. And there is a category of video conferencing software that allows multiple participants to communicate with each other. In this type of category there are many different software packages. There are quite a few professional packages, like WebEx, E/pop and E-Conference Center. Of these, WebEx is probably the most familiar. There are also free applications to use, like FlashMeeting and 1VideoConference. The last two applications apply to the criteria formulated in the beginning of this Appendix section. However, with video conferencing, another criterion comes into play. At least six to ten people must be able to participate at the same time.

❖ FlashMeeting

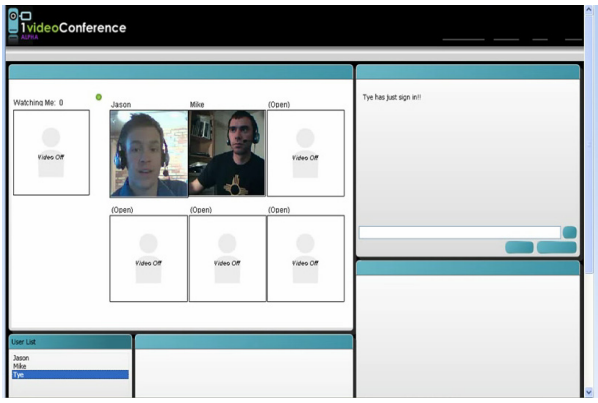
FlashMeeting is an easy and free to use video conferencing application that allows dispersed groups of people to meet each other over the internet. FlashMeeting runs on a Flash Media Server, which means that no installations are required. During the meeting one person speaks at a time, which makes the meeting organized well. The meeting is also recorded on the server and can be replayed. FlashMeeting has several functions besides video conferencing alone. Some of its features are: chat; whiteboard; vote; and URL sharing. FlashMeeting can host many participants at the same time. FlashMeeting requires Adobe Flash Player 8.0 (or higher). Web site: http://flashmeeting.open.ac.uk.

❖ 1VideoConference

1VideConference is a video conferencing application that can be integrated in a VCoP. When 1VideoConference is installed, no downloads or installations are necessary. The application is open source and is free to use. However, this application is still a Beta version, which means that there are some bugs in the software. Also the installation could be difficult. But because of its promising future, it is adopted in this Appendix section. Some of its features are: document sharing; application sharing; desktop sharing; whiteboard; chat; the hot seat (control the meeting); and people who are using a video phone, Skype or MSN can participate in the same conference. Web site: www.1videoconference.com.



Appendix V figure VI: FlashMeeting (http://flashmeeting.open.ac.uk)



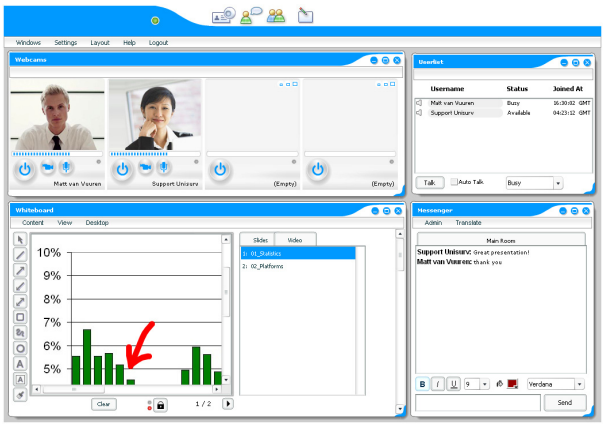
Appendix V figure VII: 1VideoConference (www.1videoconference.com)

❖ Professional packages

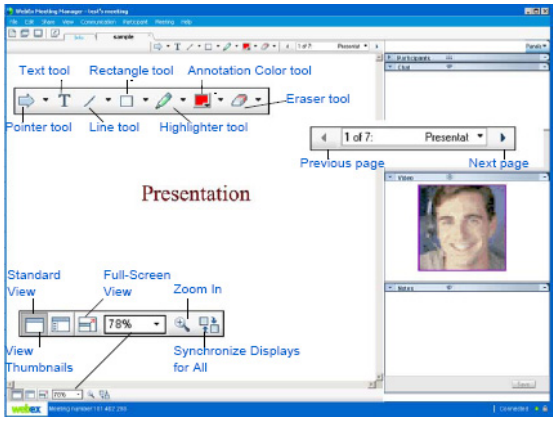
When comparing WebEx, E/pop, and E-Conference Center, the last one holds the best cards when looking at video conferencing only. It has about the same features as WebEx and costs 199.80 Dollar a month. It is a lot cheaper than WebEx (i.e. 375 Dollar a month). E/pop has many features, but costs between 350 and 900 Dollar a month or between 3000 and 9600 Dollar a year, when hosted on a local server. Some of the features of E-Conference Center are: chat; VoIP; whiteboard; desktop sharing; video recording; polling; up to 15 participants; and a schedule manager. Web site: www.e-conferencecenter.com.

WebEx and E/pop are more useful when working in documents (e.g. Word and PowerPoint files) is important. Some of the features of WebEx are: polling; desktop sharing; whiteboard; VoIP; chat; recording of the meeting; and application sharing. Editing documents can be done by using the application sharing option. There is also an option to choose for a light version of WebEx, called: WebEx Meet Me Now. With this application a maximum of ten people can participate. However, a maximum of four people, including the host, can be viewed at a time. This service costs between 39 and 49 Dollar a month. Web site: www.webex.com.

Some of the E/pop features are: polling; desktop sharing; whiteboard; VoIP; chat; recording of the meeting; application sharing; and text editing. Web site: www.wiredred.com.



Appendix V figure VIII: E-Conference Center (www.e-conferencecenter.com)



Appendix V figure IX: WebEx (www.webex.com)

Appendix V figure X: E/pop (www.wiredred.com)

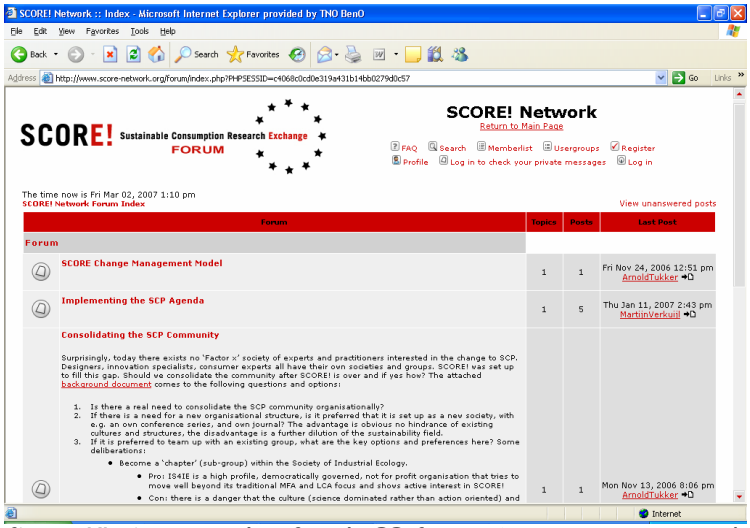
V.II Discussion forums

A discussion forum is a platform which is often used for discussion. The communication used in a discussion forum is asynchronous. Discussion forums enable communication between people who are in different areas (with different time zones). This can make a discussion forum a good platform for communication. However, when there are no key people involved in contributing to a discussion forum, it can easily die out. Another threatening fact is that communication is only text-based, which has no social cues (Preece & Maloney-Krichmar, 2003). They also state that communication takes much longer. Because communication is asynchronous, it can take days, weeks, or even months for people to react on a topic. Other downsides are that topics can become lengthy and inconvenient threads. This is due too many reactions on a topic, and due to the shuffled order of the messages. Furthermore, the contextual knowledge of participants can be questioned.

There are many free tools available for creating a discussion forum. One application, which is already integrated in the SCORE! web site, is phpBB. This tool passed the selection criteria and is presented below.

❖ phpBB

PhpBB is a bulletin board (i.e. discussion forum) created in PHP. PHP (i.e. a script language) can be used in combination with HTML (a mark-up language) to create dynamic pages. PhpBB is open source software and is free to use. Some of its features are: unlimited number of forums and categories; multiple languages; powerful search tool; multiple templates; and unlimited number of messages and users. Web site: www.phpbb.com.



Appendix V figure XI: An example of a phpBB forum (www.score-network.org/forum)

*With a look at the future it is also sensible to take a closer look at Web 2.0. A project which is still under development, called 'Informe' (www.informe.com), provides free forum hosting services with web 2.0 standards. With these standards, Informe, which is based on phpBB, can offer better user friendliness, web 2.0 design standards, blog hosting, which is described next, and RSS feeds, which is described later on.

V.III Web logs

A web log, also known as blog, is some kind of web site where content is refreshed regularly (FH, 2006). The content is presented in the style of a journal and in a reversed chronological order. Because of frequent updates of the content, RSS (see Appendix section V.X) can be used which notices if there are new messages.

Web logs are often used to provoke discussion, to shock people, and to use it as a source of self-reflection (FH, 2006). People can write down their own thoughts, and other information in web logs. Some people use it as a diary. Besides these features, web logs can also be used to create a community. When bloggers (i.e. people who are writing and posting web logs) are posting content, an audience can be triggered to react. Because web logs are easy to use, it has become a very popular tool for interaction.

An important advantage of web logs is that they spread news quickly. Web logs contain high doses of key words which are feeding search engines. Because many people look for information on the internet by using search engines, web logs are often found. However, it has the same downsides as a forum. Communication in a web log is only text-based, which means that there are no social cues. And the communication process can be slowed down (Preece & Maloney-Krichmar, 2003), because communication in web logs is asynchronous. Also the order of the messages can get mixed up, which results in unclear topics.

In a web log, a combination of text, pictures, and links can be used. Moreover, there are also web logs where videos can be stored. These web logs are called 'videoblogs'. Typical web sites who offer users to create web logs are Blogger, Web-Log, and LiveJournal.

To integrate a web log in a VCoP, different applications are needed. Besides integrated web logs, like in the Web 2.0 forum in the previous section, there are also specific applications that allow web logs to be integrated into a VCoP. Two software applications, which are free to use, and claim to be user friendly, are WordPress and B2Evolution.

❖ WordPress

WordPress is web logging software which focuses on aesthetics, web standards and usability. With WordPress web logs can be easily created. Some of its features are: spam protection; easy installation; multiple authors; comments; exposed to search engines; and configurability. Web site: http://wordpress.org.

❖ B2Evolution

B2Evolution is a classy web log tool. It has all the features of traditional blog tools, but has extended them with many features. B2Evolution is open source software. Some of its features are: anti spam; multiple web logs; search engine; text editor; reader comments and feedback; web standards; RRS; easy installation; and configurability. Web site: http://b2evolution.net.

Appendix V figure XII: WordPress (http://wordpress.org)

Appendix V figure XIII: B2Evolution web log (http://b2evolution.net)

V.IV Podcasts

A podcast is a media file that is distributed over the internet. Podcasts are a means of letting others experience events. Podcasts are often used for colleges, interviews, and even whole radio programmes. Anything that is audio recorded can be put online as a podcast. Podcasts make use of RSS. The formats of podcasts are most often MP3 or AAC. Podcasts can be listened to online, but can also be downloaded and played on an audio player, or MP3-player (e.g. iPod).

There are also possibilities to make the podcasts known to public. Web sites like Podfeed.nl collect podcasts and classify them in subjects. No additional software is needed to make podcasts. Just recording it and publishing it on the web is enough.

V.V Wiki's

Wiki's are a collection of coupled web sites that can easily be edited by anyone. The principle of a wiki is 'if you spot an error, change it, is there something missing, add it'. The goal of wiki's is to generate knowledge together. Wiki's can be used by individuals, but most of the time wiki's are used by groups to create a knowledge construction (FH, 2006). A Wiki is a collaborative writing tool.

Two disadvantages of using wiki's are found. The first one is vandalism. People can deliberately remove texts from wiki's and insert false information. This can however be easily dammed in by using registration, in order to let people edit wiki pages, who have the right to do so. Wiki pages can however be easily restored to a previous version. The second disadvantage is that the quality of information on a wiki page can not easily be determined.

The most well-known web site that is using the wiki principle is Wikipedia (i.e. an online encyclopaedia). However, wiki's can also be integrated in VCoP. There are many applications that provide wiki technology and it is hard to make a distinction between them. Examples of wiki technologies that can be integrated into a VCoP are PmWiki and MediaWiki.

❖ PmWiki

PmWiki is a tool to create and maintain collaborative web sites. It looks and acts like normal web pages, but now the pages can be easily edited. Some of its features are: spam protection; search tools; page history; configurability; and possibilities to integrate RSS. Web site: www.pmwiki.org.

❖ MediaWiki

MediaWiki is a tool that is originally written for Wikipedia. With this tool collaborative web pages can be easily created and maintained. Some of its features are: page history; discussions; multiple languages; editing; and search tools. Web site: www.mediawiki.org/wiki/mediawiki.

V.VI Collaborative real-time editing

Collaborative real-time editing means that people can work on a single document at the same time. Changes are immediately visible, and it makes brainstorming possible (FH, 2006). There are three types of collaborative real-time editing. The first one is text-based real-time editing. This means that people can work in one environment on documents while discussing it with typed text. The second one is real-time editing with the inclusion of video footage. This is already explained in the section about video conferencing. And the third type is whiteboards. With whiteboards people can use drawing tools which are facilitated by text-based chat. The three highlighted applications are: Gobby (i.e. a text-based collaborative real-time editing application); Vyew (i.e. a whiteboard application); and Google Docs & Spreadsheets (i.e. a web-based text-based collaborative real-time editing application). These applications can not be integrated in a VCoP, but are user-friendly and can be used for free.

❖ Gobby

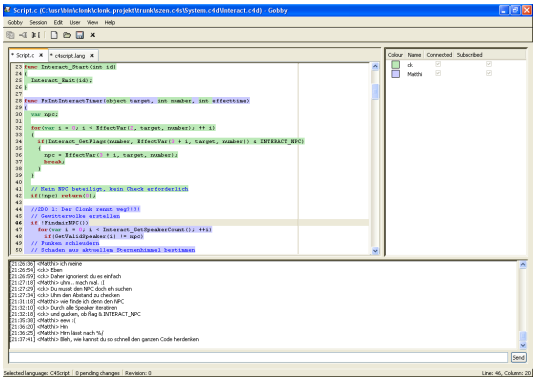
Gobby is a collaborative editor which supports multiple documents in one session. Collaboration takes is facilitated by text-based chat. A Gobby-client needs to be downloaded and installed on a local hard disk. It runs on all computer systems. Some of its features are: real-time collaboration; each user has its own colour; session password protection; and document synchronization on request. Web site: http://gobby.0x539.de/trac/wiki. Another application in this is CoWord (http://cooffice.ntu.edu.sg/coword). CoWord maintains the look-and-feel of Microsoft Word, which gives the users an advantage to better understand what they are doing.

❖ Vyew

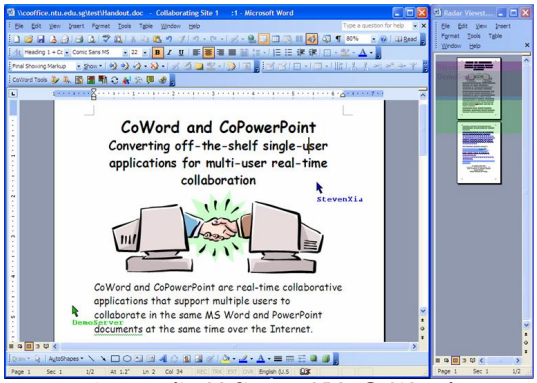
Vyew is a web-based collaborative conferencing application which provides shared visual communication. Vyew can host up to twenty participants. If more participants are needed an advanced version of Vyew can be used. In that case, a monthly fee between seven and twenty dollars has to be paid. Some of its features are: collaboration with Microsoft Office files, Adobe PDF files, images, and much more; desktop conferencing; chat; and teleconferencing. No installations are required and all content is saved in Vyewbooks. VoIP is coming soon, which makes it an effective way to work. Vyew is purely a whiteboard and has unfortunately no possibilities to edit text directly yet. Web site: www.vyew.com.

❖ Google Docs & Spreadsheets

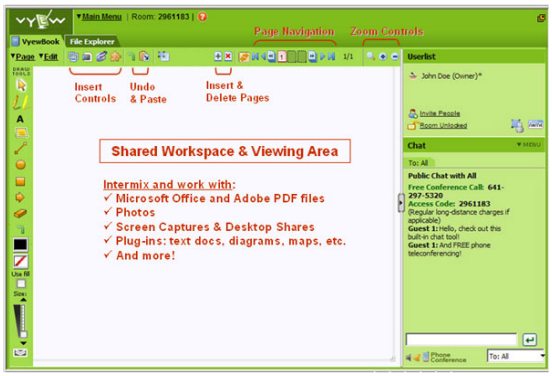
Google Docs & Spreadsheets is an online application where people can make and edit documents and spreadsheets. At this moment, the application only supports Word, Excel, and HTML documents, and only supports text-chat in the spreadsheet section. There is thus no option yet to add PowerPoint and PDF files. Because it is likely that Google will apply other files in this application, as well as a chat possibility in the document section, Google Docs & Spreadsheets has earned a place in this Appendix section. Some of its features are: invite people to collaborate on a document; documents can be published as HTML pages; spelling check; revision of earlier versions; comments; and a history log. Web site: http://docs.google.com. A comparable online application is Zoho Writer (http://writer.zoho.com).



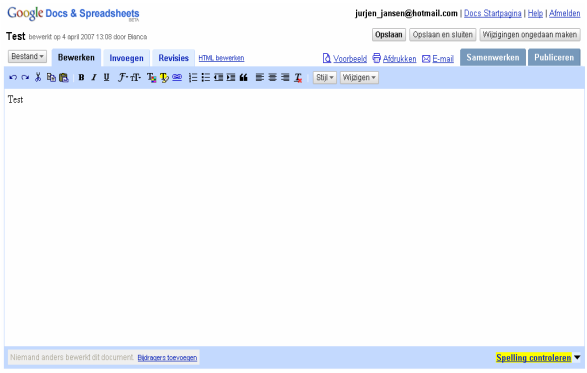
Appendix V figure XIV: Gobby (http://gobby.0x539.de/trac/wiki)



Appendix V figure XV: CoWord (http://cooffice.ntu.edu.sg/coword)



Appendix V figure XVI: Vyew (www.vyew.com)



Appendix V figure XVII: Google Docs & Spreadsheets (http://docs.google.com)

V.VII Virtual worlds

Virtual worlds are approaching to be an online version of the real-life. People walk through 3D environments and can do several actions, like chatting with people they come across (FH, 2006). They interact with their avatar (i.e. a graphical representation of oneself). Virtual worlds are stand-alone products and are accessible to millions of people. It is maybe one of the best examples of social computing.

There are a lot of (i.e. more than 50) virtual worlds on the internet, both 2D and 3D. Examples of 3D virtual worlds are Active Worlds (www.activeworlds.com) which has a Dutch version as well (www.3dee.nl), Muse (www.musecorp.com), and SecondLife (www.secondlife.com). SecondLife is the most interesting one with its popularity over seven point three million users. However, about 40,000 users are regularly visiting SecondLife.

SecondLife is a new and exciting venue for collaboration, training, distance learning, new media studies and marketing. In a broad sense, SecondLife can be used for four main purposes. These purposes are: presenting, promoting, and selling content to a broad online audience; collaborating and communicating in real-time between multiple participants; 3) researching new concepts and products; and 4) training and educating in virtual classrooms. Web site: www.secondlife.com.

SecondLife is an example of how people might exchange knowledge in the future. It is not yet to say if SecondLife is going to be the platform for it. SecondLife has the disadvantage that it does not have open standards yet. Its source code is however become open source in May 2007. Another negative aspect of SecondLife is that it is running completely on the servers of Linden Lab (i.e. the creators of SecondLife). This means that is unsure how people's integrity and privacy are treated.

Appendix V figure XVIII: SecondLife (www.nevillehobson.com)

V.VIII File-sharing systems

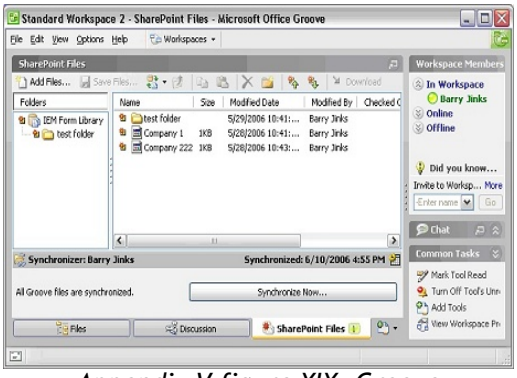
The phrase file-sharing system uncovers its functionality perfectly. It is a system which makes it possible to share files (e.g. with project partners). Besides sharing files alone, file-sharing systems often provide other functionality like agendas and chat capabilities. There can roughly be made a distinction between two types of file-sharing systems, namely: peer-to-peer systems; and web based systems.

In a peer-to-peer system, the users are in contact with each other when they are online. People can share folders with each other, which gives them the opportunity to easily sync their documents.

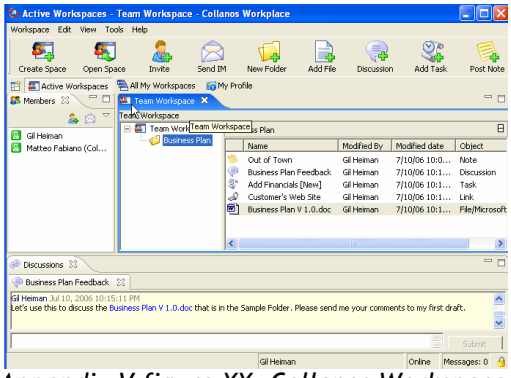
An example of a peer-to-peer system is Groove. Groove is a virtual workspace where people can share files and join conversations. Some benefits of Groove are: it needs no IT assistance; it can people make work faster; it allows all information to be stored in one central place; and it allows working with the same information. However, Groove is not a free-to-use application. Web site: www.groove.net

Another example is Collanos Workspace. This system allows sharing document, initiate discussions, and manage tasks as well. This system also uses peer-to-peer technology. With this system, it is possible to work both online and offline and it has the advantage that it can be used for free. Web site: www.collanos.com

Besides these two peer-to-peer systems, there are also web based tools that allow for document storing and sharing. One example is File2Share (www.file2share.nl), another example is Viadesk (www.viadesk.nl). These web based tools have about the same features as the peer-to-peer variant, but do not have to be installed on an individual computer. They are accessible via the internet.



Appendix V figure XIX: Groove
(www.offlinesharepoint.com)

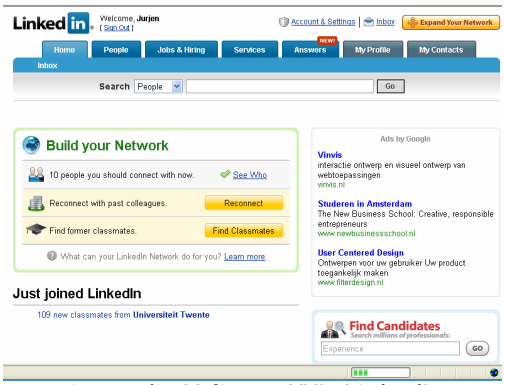


Appendix V figure XX: Collanos Workspace
(www.collanos.com)

V.IX Social network services

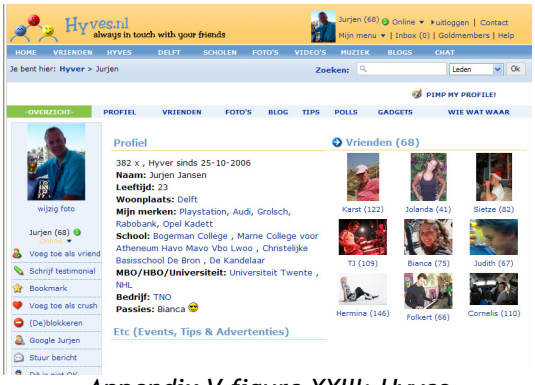
Social network services are basically coupling people with each other (FH, 2006). This kind of technology allows people to leverage personal connections. These tools allow people to find other people with similar interests. When people have found each other they often interact with each other by different kinds of social software described earlier in this Appendix section.

Examples of social network services are: LinkedIn (www.linkedin.com); MySpace (www.myspace.com); Hyves (www.hyves.nl) and Friendster (www.friendster.com).



Appendix V figure XXI: LinkedIn
(www.linkedin.com)

Appendix V figure XXII: MySpace
(www.myspace.com)



Appendix V figure XXIII: Hyves
(www.hyves.nl)

Appendix V figure XXIV: Friendster
(www.friendster.com)

V.X Really Simple Syndication (RSS)

Really Simple Syndication (i.e. RSS) basically provides a short item list which consists of content that regularly or irregularly changes. This item list is presented in a so-called 'feedreader'. The feedreader shows brief information to the user, like subject, title, and place (FH, 2006). RSS is seen as a nice tool which lets people keep up with their favourite web sites in fast and efficient ways.

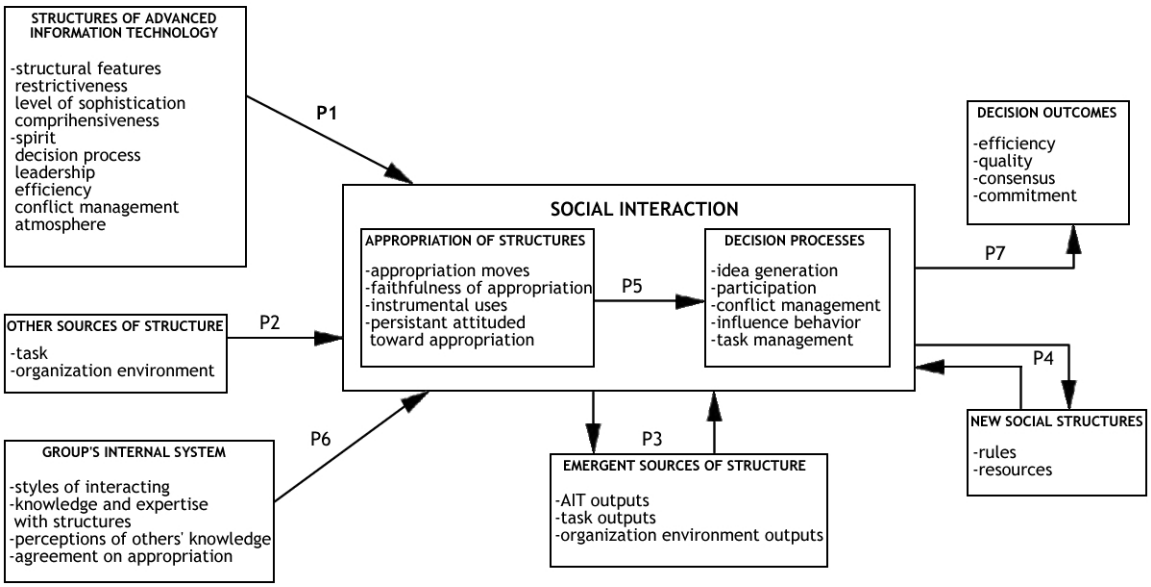
RSS can be used with all kind of software. It can include information about web logs, changes made in wiki's, the top ten of most read articles on a particular web site, an overview of the latest movies, etcetera.

Appendix V figure XXV: RSS Logo (http://wikipedia.org)

APPENDIX VI: ADAPTIVE STRUCTURATION THEORY

In this Appendix section, the Adaptive Structuration Theory (further referred to as AST) is described. This theory might be a useful guide, in order to analyze how new technology is used within a VCoP. It can also be used to evaluate the tools that are used within the VCoP.

The AST is becoming an influential theory to use for research on advanced information technologies (Chin, Gopal & Salisbury, 1997). The AST (see figure VI.I) has been approached by DeSanctis and Poole (1994) as a means of studying the role of advanced information technologies during organization change. A key factor in organizational change is the adaptation of technology structures by organizational actors. The change processes are examined from two vantage points in the AST. These vantage points are: the types of structures that are provided by advanced technologies; and the actually emerging structures in human action when they are interacting with these technologies. People adapt systems to their needs. They might also refuse to use systems or fail to use them at all (DeSanctis & Poole, 1994).



Appendix VI figure I: Major constructs and propositions of the Adaptive Structuration Theory
(DeSanctis & Poole, 1994)

DeSanctis and Poole (1994, p. 128-131) have articulated seven propositions that apply to the AST. These propositions are described in the table below (see table VI.I).

Proposition	Description
Proposition 1	Advanced information technologies provide social structures that can be described in terms of their features and spirit. To the extend that advanced information technologies vary in their spirit and structural features sets, different forms of social interaction are encouraged by the technology.
Proposition 2	Use of advanced information technology structures may vary depending on the task, the environment, and other contingencies that offer alternative sources of social structures.
Proposition 3	New sources of structures emerge as technology, environmental structures and tasks are applied during the course of social interaction.

Proposition 4	New social structures emerge in group interaction as the rules and resources of an advanced information technology are appropriated in a given context and then reproduced in group interaction over time.
Proposition 5	Group decision processes will vary depending on the nature of advanced information technology appropriations.
Proposition 6	The nature of advanced information technology appropriations will vary depending on the group's internal system.
Proposition 7	Given advanced information system and other sources of social structure, $n_1 \ldots n_k$, and ideal appropriation processes, and decision processes that fit the task at hand, then desired outcomes of advanced information technology use will result.

Appendix VI table I: Propositions of the AST (DeSanctis & Poole, 1994)

The AST tries to strengthen other structuration models (e.g. socio-technical systems theory; structuration theory; and structural symbolic interaction theory). The other structuration models purely focused on technology, whereas DeSanctis and Poole (1994) try to capture the mutual influences of advanced technology structures, and the social structures which emerge during interaction with the advanced information technologies. The main goal of the AST is to tackle the central paradox of structuration: *"identical technologies can occasion similar dynamics and yet lead to different structural outcomes"* (Barley, 1986, p. 105, cited by: DeSanctis & Poole, 1994). In short, the AST tries to describe the interrelationship between technology, social structures, and human interaction (DeSanctis & Poole, 1994).

The AST is mainly based on Anthony Giddens' Structuration Theory (Chin et al., 1997). Structuration can be seen as a production and reproduction process of social structures in social life. It can be concluded that organizational change, when triggered by technology, needs time to occur. The AST defines two types of structures. On the one hand there are structures in technology, and on the other hand there are structures in action. These two structures are narrowly related to each other (i.e. there exists a recursive relationship between them). This means that they are shaping each other in an iterative way (DeSanctis & Poole, 1994).

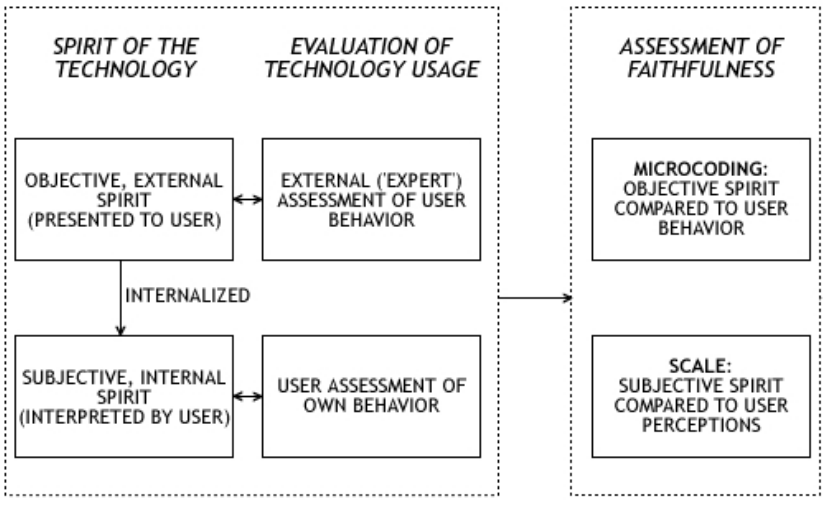
The social structures are described in two ways by the AST. These social structures are: the structural features (i.e. specific rules and sources or capabilities provided by the system); and the spirit of a given technology (the values and goals underlying the system features). The spirit can be identified according to five properties. These properties are: the design metaphor underlying the system; the features it incorporates and how they are named and presented; the nature of the user interface; training materials and online guidance facilities; and other training or help provided with the system. The combination of the structural features and the spirit form a 'structural potential'. By forming structural potential, groups can employ to produce specific social structures in interaction (DeSanctis & Poole, 1994). Chin et al. (1997, p. 348) define spirit as *"the original design intent of the system developers."* They have chosen this definition, because the definition of DeSanctis and Poole (1994) can sometimes lead to misinterpretations.

Technology, tasks, and organizational environment are the major sources of structure for groups while they are interacting with advanced information technology. The output of these three sources will then become additional sources of structure (DeSanctis & Poole, 1994). The authors have constructed a table (see table VI.II on the next page) to illustrate this.

Structure source	Definition
Advanced information technology	Advanced information technology including hardware, software, and procedures
Advanced information technology output	Data, text, or other results produced by advanced information technology
Task	Task knowledge or rules, includes facts and figures, opinion, folklore, or practice related to the task at hand
Task output	The results of operating in task data or procedures, the results of completing all parts of a task
Environment	Social knowledge or rules of action drawn from the organization or society at large
Environment output	The results of applying knowledge or rules drawn from the environment

Appendix VII table II: Major sources of structures (DeSanctis & Poole, 1994)

Deeper structuration processes (i.e. immediate, visible actions) are called 'appropriations of the technology' (Ollman, 1971, cited by: DeSanctis & Poole, 1994). Technology designs do not automatically determine appropriations, but this determination process is done by people who actively seek how technology structures are used. To illustrate variation in interaction processes, at least four appropriation aspects can be identified. The four appropriations are: structural features can be appropriated in different ways, which may invoke one or more appropriation moves; technology features can be appropriated faithfully or unfaithfully; the features can be appropriated for different instrumental uses, or purposes; and as technology structures are appropriated the group can display various attitudes. Group appropriations on available structures can be influenced by several factors (i.e. the style of interacting; the degree of knowledge and experience with the structures; the belief that others accept and use the structures; and the agreement how the structures should be appropriated) (DeSanctis & Poole, 1994). Chin et al. (1997) constructed a graphical overview which shows the relationship between spirit, usage, and faithfulness (see figure VI.II).



Appendix VI figure II:
The relationship between spirit, usage, and faithfulness (Chin et al., 1997)

To carefully understand the adaptive processes, a diachronic analysis is needed. To conduct a diachronic analysis, ten steps need to be executed. These steps can be identified as follows: describing the structure of the advanced information technology; describing other available structures; describing the group composition; developing hypotheses about advanced information technology appropriation; assessing the extend of advanced information technology appropriation, degree of faithful use, types of instrumental uses, and attitudes toward appropriation; developing hypotheses about decision processes; assessing decision processes; developing predictions about decision outcomes and new social structures; assessing decision outcomes; and describing new social structures (DeSanctis & Poole, 1994).

Analyzing appropriateness (i.e. step five) can be done at three levels. These three levels are: micro level; global level; and institutional level. Micro level analysis examines appropriation in speech or other acts. Global analysis examines conversations, meetings, or documents as a whole. Institutional level analysis examines persistent changes in behaviour when new technology is introduced (DeSanctis & Poole, 1994).

Chin et al. (1997) tried to make the usage of the Adaptive Structuration Theory less complex. They have done this by constructing items to test the faithfulness of appropriation. Faithfulness of appropriation is: *"the extend to which a group's use of system structures is consistent with the original design intent of the system developers"* (Chin et al., 1997, p. 348). As a result of their study, they have found five well validated items. The faithfulness of appropriation items found by Chin et al. (1997, p. 349) are:

- The developers would probably be shocked at how the group used the system
- The group probably used the system in relatively novel ways (i.e. improperly)
- It would be ironic to have the original developers of the system see how the group used the system (i.e. would view the group's use of the system as inappropriate)
- The group failed to use the system as it should have been used
- The system is not used in the most appropriate fashion

APPENDIX VII: VCOP MEMBER ROLES

In this Appendix section an overview is giving of what kind of roles people can have within a VCoP.

Members who are participating in VCoPs can have different characteristics or roles. Blanchard (2004) defines six types of members, which are categorized in three different categories. The first category contains the leaders. The first type of leader is the technical leader (i.e. the moderator). This person makes sure that the functions of the VCoP are running appropriately. Another type of leader is the information leader. This person is the major provider of expertise and knowledge about a topic. The third type of leader is the social leader. This person is a major provider of social support to other community members.

In the second category, the members of the VCoP take a central place. Community members (should) contribute to the VCoP on a continuous basis. Leaders and members are crucial for a VCoP to survive.

Lurkers can be found in the third category. There are two different types of lurkers. The first type is known as private communicators. These community members only communicate with other members via private email. The other type is known as members who never communicate. They make use of other member's contributions, but are never contributing or communicating themselves. Though lurkers may seem as a negative phenomenon, they have an important role too. They should be considered as potentially active members, or an audience for the active members (Blanchard, 2004).

Facilitators and moderators are playing an important role in sustaining a VCoP. A facilitator is a person who directs (electronic) discussions, whereas a moderator is a personal who regulates the technology. Moderators are often seen as the administrators of the VCoP.

Tarmizi and De Vreede (2005) conducted a study, in order to develop a facilitation task-taxonomy for CoPs (see table VII.I). They first distinct two broad categories, namely: internal and external. Internal refers to the processes inside the CoP, and external refers to the functioning of the CoP as a whole. Then they split up each category in three narrower categories. The three categories of internal are: information source (i.e. all tasks that are related to providing information to the members of the CoP); inspirator (i.e. all tasks to encourage members to participate in the CoP); and guide (i.e. all tasks to assist and advice members of the CoP). The three categories of external are assembled as follows: information source (i.e. all tasks that are related to providing information to the outside world); public relations (i.e. all tasks to represent the interests of the CoP to the outside world); and investigator (i.e. all tasks on searching and collecting useful information for the CoP and its members).

Internal	External
Information Source ❖ Listen to, clarify and integrate information ❖ Understand technology and its capabilities ❖ Create comfort with and promote understanding of the technology and technology outputs ❖ Present information to the group ❖ Answer new member's concerns ❖ Inform management concern to members	Information Source ❖ Communicate with other communities ❖ Respond to request from outside ❖ Share experience with potential communities ❖ Report progress to sponsors and/or management

Inspirator ❖ Create and reinforce an open, positive and participative environment ❖ Develop and ask the right questions ❖ Promote ownership and encourage group responsibility ❖ Encourage and/or support multiple perspectives ❖ Encourage new members to participate ❖ Present new members to the community	Public Relations Manager ❖ Initiate contact to potential members ❖ Promote community-to-be to potential members ❖ Implement strategy to attract new members ❖ Advocate community independency before to management ❖ Act as a moderator between management and community
Guide ❖ Plan and design meetings ❖ Keep group outcome focused ❖ Select and prepare appropriate technology ❖ Direct and manage meeting ❖ Actively built report and relationships ❖ Manage conflict and negative emotions constructively ❖ Scan the community ❖ Come up with suggestions ❖ Guide community to match organizational process	Investigator ❖ Scan the environment ❖ Gather information from various sources

Appendix VII table I: The CoP facilitation task-taxonomy (Tarmizi & de Vreede, 2005)

Tarmizi et al. (2006) used this taxonomy to identify the most difficult and important tasks for facilitators. The top three most difficult tasks are: encourage new members to participate; promote ownership and encourage group responsibility; and create and reinforce an open, positive and participative environment. The most important tasks for facilitators are: create and reinforce an open, positive, and participative environment; encourage new members to participate; and listen to, clarify, and integrate information.