Group dynamics and the role of ICT in the life cycle analysis of community of practice-based product development: a case study

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Abstract

Purpose – *This paper aims to examine the dynamics of a community of practice (CoP) through a case study of eCars – Now! They offer open-source blueprints of the electric conversion kits globally. The authors analysed the CoP by considering its entire life cycle, starting from the motives for its establishment, through its active performance, up to the current stage, where the members need to decide whether the community will remain viable. Particular attention was paid to the group dynamics and issues that seemed relevant to the change in dynamics which determine whether a CoP maintains its vitality or dissipates.*

Design/methodology/approach – *The qualitative case study was chosen as the research strategy (Yin, 1984) to answer the research question and understand the target phenomenon of the CoP by analysing textual data. This particular case was chosen because of its unusual revelatory value for the case CoP which aims at creating a tangible innovation by using a platform that normally aims at intangible problem-solving (Eisenhardt and Graebner, 2007). In the data collection, the authors used method and researcher triangulation (Patton, 1990).*

Findings – *Life cycle analysis revealed four themes that explained the change in the group dynamics and the dispersal of the community: differentiation and dispersal of interests, growth that resulted in role differentiation, virtuality in community development and inclusion of investors. The themes were all related to the fact that the case community operated with not only knowledge, but also with a tangible product. Therefore, the tangibility of a problem to be solved seems to play a pivotal role in a CoP's operations and dynamics and, in part, also explains the changing role of information and communications technology (ICT) in the process.*

Research limitations/implications – *However, this paper identified also different ways to characterize community participation, which was also relevant from group dynamics point of view. Thus, the topic should be studied further. Group dynamics in general, as it relates to the success of CoPs, should be also investigated further. Additional studies should implement the inclusion of external resources in the community. Further research is also needed to investigate tangible and intangible outcomes achieved through CoPs. Much of the available research was conducted over short periods; prolonged interactions in a CoP context could show different results.*

Practical implications – *In conclusion, at the beginning of the life cycle of the eCars community, ICT played a significant role. It helped increase awareness of the community in the first place and enabled people to join in, which thus enabled the community to evolve. When the operations evolved and the life cycle progressed, both the physical meeting place as well as personal interaction and communication became emphasized and much more important. In the maturing stage, the role of ICT, and especially social media, is the essential part of the community.*

Social implications – *This analysis suggests that at the early stage of a community, the plans can be somewhat random, even utopian, but when the community evolves, this uncertainty can become a problem. First, it affects achieving the actual, and in this case, concrete results. Second, uncertainty and unclarity dampen enthusiasm and motivation, which are of utmost importance due to the voluntary participation. This paper also concludes that when the operations evolved and the life cycle*

progressed, both the physical meeting place as well as personal interaction and communication became increasingly important.

Originality/value – *This paper argues that the ideological basis for this kind of community should be openness. All information should be available for everyone who registers to the community platform on the internet. This community was working in the mindset of open innovation. Technical documentation and all other material were available for everyone in the community's wiki pages, which attracted a lot of people who were delighted by eCars. Many advisors delivered technical information and good advice to the practitioners of the community through the platform. The hang arounds were also very well-informed in this stage regarding how the core group was working.*

Keywords *Communities of practice, Information technology, Open innovation, Social networks, Knowledge creation, Group dynamics*

Paper type *Case study*

1. Introduction

According to Cartwright and Zander (1960, p. 7), group dynamics apply to a "field of inquiry dedicated to advancing knowledge about the nature of groups, the laws of their development, and their interrelations with individuals, other groups, and larger institutions". Group dynamics assign a set of norms, roles and relations in a certain social group with a common goal. Members of the group create interdependency, through which the behaviours, attitudes, opinions and experiences of the members are collectively influenced by all other group members (Wageman, 1995). Some argue that the business community is missing an understanding of what kind of social structure can effectively promote learning, develop skills and manage information (Uzzi, 1997; Wenger *et al.*, 2002; Zahra and George, 2002). Communities of practice (CoPs) as open-innovation platforms have been regarded as useful tools to share and manage knowledge internally and with other stakeholders (Hafkesbrink and Schroll, 2011; Michaelides and Kehoe, 2007).

According to Wenger (1998b), knowledge creation in a CoP takes place when people are involved in problem-solving and are willing to share enough information to solve the problem. New knowledge can be produced by converting tacit knowledge to explicit knowledge by communicating through the social process between individuals (Nonaka and Takeuchi, 1995; Puusa and Eerikäinen, 2010). Individuals' tacit knowledge is often the most valuable knowledge in a community, because it consists of people's expertise and deep understanding of complex issues and enables the provision of adaptive responses to context-specific problems (Wenger *et al.*, 2002). For people to share their tacit knowledge requires a close involvement of the community and the cooperation of all as well as use of networks and face-to-face contact, which increases mutual understanding and trust (Lam, 2000; Ardichvili *et al.*, 2003). Tacit knowledge is transmitted in a CoP as an informal learning process, through storytelling, discussion and coaching (Wenger *et al.*, 2002). Through these processes, members of the CoP are able to increase their own understanding and increase the collective knowledge of their community (Brown and Duguid, 1991, 1998). Thus, a CoP provides a social context (Correia *et al.*, 2010) which all can use to learn together, based on the fact that people exchange knowledge and common practices and have a collective identity (Wenger, 1998a; Kirschner and Lai, 2007; Correia *et al.*, 2010).

This article examines a case CoP which was chosen because of its unusual revelatory value (Eisenhardt and Graebner, 2007); it aimed at creating tangible innovation by using a platform that normally aims at intangible problem-solving (Wenger and Snyder, 2000). A qualitative case study was conducted, and one CoP-based product development process was analysed by considering the CoP's entire life cycle, starting from an analysis of the motives for its establishment, through its active performance, up to the current stage, where the members need to decide whether the community will remain viable. This article aims at deepening the understanding of group dynamics in a CoP; in the analysis, particular attention is paid to issues which seem relevant to a change in dynamics. Some new characteristics associated with roles within the community and the successful usage of information and communications technology (ICT) are also identified. This study demonstrates that effectively deployed wikis and blogs offer one important channel to

"Virtual communities of practice (VCoPs) members are usually connected to each other by ICT solutions."

enhance community members' engagement and collaboration within digital communication environments.

The study aims to answer the following research question: "What are the critical features that explain the change in group dynamics and also help explain why a CoP maintains or loses its vitality?" The case reveals the interconnectedness between the core idea of CoPs and group dynamics by describing how the dynamics are affected by varied agendas and by members who join the CoP with interests which are not in accordance with the CoP's original idea but are solely finance-based. It is argued that if the participants value only concrete results and look only for their potential monetary value, it disrupts the group dynamics, erodes the group's voluntary nature and thus undermines the entire idea of CoPs.

2. Communities of practice and virtuality

Lave and Wenger (1991) initially defined a CoP as a naturally occurring, informal and self-organizing community that elects its members. Wenger *et al.* (2002, p. 4) later revised this definition by stating that CoPs are "groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis". Wenger *et al.* (2002) continue by saying that the CoP can also be generated on purpose, and it may be a semiformal part of an organization. The original definition of a CoP is as a relatively stable community where members work in close interaction near to one another and in which identity is formed through participation and negotiation, all of which is central to learning and knowledge creation (Amin and Roberts, 2008). Kodama (2005) states that the organization's ability to share tacit knowledge affects the organization's innovation processes. CoPs have also been considered an innovative way to manage information and maintain innovation processes (Lesser and Prusack, 1999; Swan *et al.*, 2002).

In practice, some CoPs regularly organize face-to-face meetings among their members who are working close to each other (Amin and Roberts, 2008), while some CoP members are connected to each other primarily by email or through internet applications that enable a dynamic, global, virtual and real-time interaction (McLure *et al.*, 2000; Ardichvili *et al.*, 2003).

Virtual communities of practice (VCoPs) members are usually connected to each other by ICT solutions. To allow virtual cooperation, they use technical tools such as email, video conferencing, newsgroups, online meetings, common databases, websites and intranets. VCoPs can also use many traditional tools such as telephones and telephone conferences (Barrett *et al.*, 2004). In many multinational organizations, VCoPs are widely used as knowledge management (KM) tools (Ardichvili *et al.*, 2003). In the past, CoPs were occasionally used in organizations without planning and management, but today, organizations see CoPs as critical resources, and they are well taken care of (Brown and Duguid, 2001; McDermott, 2000; Schwen and Hara, 2003;. Swan *et al.*, 2002; Thompson, 2005; Wenger and Snyder, 2000).

2.1 Principles for community development

According to Burk and Sutton (2000), a successful CoP is organized around the needs of its members. Thus, COPs can be of different sizes and can be structured in different ways

and use a variety of ways to stay connected. The key to a successful CoP is the motivation of the members to participate actively in the creation and sharing of knowledge (Ardichvili *et al.*, 2003).

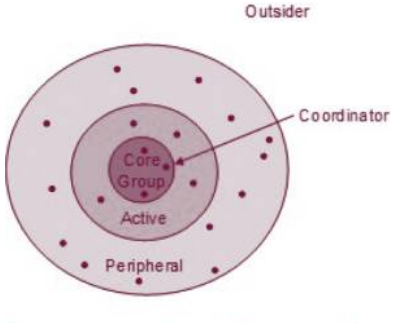
The structure is generated on the basis of the members' mutual relations. The group structure can be interpreted by the roles of the members as well as norms, values, modes of communication and status differences (Jex and Britt, 2008). Wenger *et al.* (2002) argued that a good community architecture comprises many levels of participation and different reasons for participating. They identified three main levels of community participation, as illustrated in Figure 1.

A small core group actively participates in discussions and debates, occupying the public forum and carrying the community according to the learning objectives. This group forms the heart of the community (Wenger *et al.*, 2002). Wenger *et al.* (2002) argue that the core members of the group usually lead the community and assist the community coordinator. Second-level participants form a small active group, but it does not work at the same regularity and with the same intensity as the core group. A third group of community members is at the outer periphery, and these members rarely participate in community activities. While these members may consider their participation meaningless for the whole community, they are an essential dimension of a CoP (Wenger *et al.*, 2002). The fourth group consists of people around the community, who are not members but who are interested in its subject matter and the mission. This group may include customers or suppliers and exhibit the same spirit as their neighbours (Wenger *et al.*, 2002).

2.2 Stages of the community

Group formation generally begins when a psychological bond is formed among individuals. In the social identity approach, the group begins to form when a group of individuals are familiar parts of the same social group (e.g. doctors, students or plumbers), and the attraction between people is only essential to strengthen the link between individuals (Hogg and Williams, 2000). The interaction among individuals develops the group norms, roles and attitudes, which define the group and its internal functioning (Sherif, 1936). Emergent established groups are formed spontaneously. These groups are missing any previously designed structures or roles and any previous experience of working together (Majchrzak *et al.*, 2007). There is a strong interdependence among the participants in coordinating the information, resources and tasks in groups (Majchrzak *et al.*, 2007). According to Levine and Moreland (1998), different roles involve defining different roles of group members. Norms are rarely written down or even discussed, but they have a powerful impact on the group's behaviour (Greenberg and Baron, 2008; Hahn, 2010). Members of the group work together to develop these norms, which provide identity and a sense of security to the

Figure 1 Degrees of community participation



Source: Adapted from Wenger *et al.* (2002)

individuals (Brooks, 2009). According to Schwartz (2007), the values are the goals or ideals, which constitute the guiding principles of the group.

The motivation to work in a group depends on the personal benefits received by each member of the group. According to Bass (1960), the existence of the group formed is rewarding in itself for each of its members, although the group objectives are crucially important in the motivation to participate. Mabry and Barnes (1980) argued that the group is formed by a network of people who have obviously invested the power of personal decision-making in part of a larger social entity (referred to as a group) in their pursuit of a common goal that would be unreachable for individuals.

Figure 2 illustrates how a typical CoP continually evolves (Wenger, 1998b). Wenger identified five stages of community development – potential, coalescing, active, dispersed and memorable – each characterized by different levels of interaction among the members and various kinds of activities.

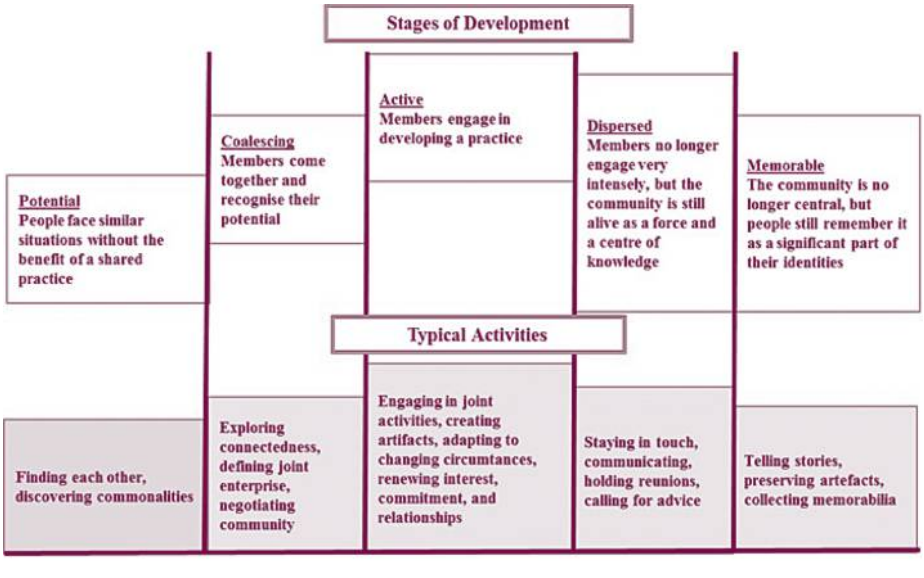
Community development starts with the social network, which usually attracts an informal group of people who start networking. Coalescing is important in getting to work, because it allows individuals to build relationships and trust and an awareness of common interests and needs. Communities thrive when members receive the added value of participation (Wenger *et al.*, 2002).

During the maturation phase, the most important thing is to move from the establishment to clarify the focus of the community, its roles and boundaries. This is a very active phase for the community coordinators and support staff, who often break apart or rearrange the community (Wenger *et al.*, 2002).

The radical transformation or death of the community in its life cycle is as natural a step as any stage in a process of birth, growth and life (Wenger *et al.*, 2002). During this change, people leave the community if it is no longer useful, directly or indirectly (Saint-Onge and Wallace, 2003).

Most communities have mechanisms allowing members of the community to solve problems and share ideas. Communities that are focused on assistance typically create forums where people consider the relationships between the geographical distance or

Figure 2 Stages of development of communities of practice



Source: Modified from Wenger (1998b)

business units of different teams, decide what kind of information they will share with the others and consider how they can produce added value as well as good ideas for the whole community (Wenger *et al.*, 2002).

2.3 The role of ICT

According to Soto-Acosta *et al.* (2013), during the past decades, KM has emerged as a key discipline that explains organizational learning and innovation. ICTs help facilitate knowledge acquisition and creation, knowledge dissemination and knowledge utilization, meaning that KM practices are strongly supported by ICTs (Soto-Acosta *et al.*, 2015; Jayasingam *et al.*, 2012). Sigala and Chalkiti (2014) argued that with the recent appearance of Web 2.0, the term "KM 2.0" has been coined to summarize new trends in KM. They define KM 2.0 as the acquisition, creation and sharing of collective intelligence through social networks and communities of knowledge.

The internet has created many new possibilities for communication and social interaction. For example, forums and newsgroups are increasingly the focal points of new kinds of interaction between individuals and different virtual communities (Komito, 1998; Etzioni and Etzioni, 1999; Bakardjieva and Feenberg, 2002; Wilson and Peterson, 2002). According to Komito (2011), social media allows people to monitor voice, video, text and pictures to maintain a low level of mutual understanding and to support fragmented community relations. By promoting bonding capital, it supports the enhancement of scattered communities (Komito, 2011). According to Palacios-Marquès *et al.* (2015), it is essential to assimilate internet technologies to support information sharing and knowledge exchange within firms. Hence, it is important to understand which factors influence the use of internet technologies for knowledge exchange (Palacios-Marqués *et al.*, 2015).

Those who do not want to comment on other blogs resemble lurkers in other virtual communities (Blanchard, 2004). Lurkers are members of a virtual community and regularly read the messages, but they do not join in the conversation (Blanchard, 2004). Many researchers believe that "lurking" is a negative phenomenon (Kollock and Smith, 1996). However, it can be seen that the majority of online community members are lurkers (Blanchard and Markus, 2003). Blanchard and Markus (2003) reported that lurkers have a clear sense of membership in online communities, even though this sense is weaker than that of the more active members.

It has also been argued that virtual communities increase their participation in traditional face-to-face communities, which enhances democracy and other community activities (Bakardjieva and Feenberg, 2002; Blanchard and Horan, 1998; Schuler, 1996).

According to Soto-Acosta *et al.* (2014a, 2014b), organizational factors should not restrict but should facilitate the implementation and usage of internet technologies. Jewell and Walker (2005) highlight the fact that only through dialogue can one ensure that the context of the knowledge flow is in line with the recipients' needs. For this reason, the most effective knowledge channels in an organization tend to be the personal networks which form the basis of many CoPs (Jewell and Walker, 2005). According to Jewell and Walker (2005), one key to successful KM can therefore be defined in terms of understanding, supporting, expanding and influencing these networks through the definition and management of CoPs and the implementation of appropriate technology to support such CoPs.

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One of the most successful models is the application of community practices in which group members are able to explore their knowledge and exchange information through synchronous discussion boards (Godwin-Jones, 2003). This Web-based technology supports collaborative learning which enriches learning performance, both for individual knowledge construction and group knowledge sharing (Liaw *et al.*, 2008).

For example, a blog is constructed by people who share mutual interests; it allows them to collaboratively set objectives, regulations and formats, and this is what distinguishes blogs from other types of websites (Godwin-Jones, 2003; Richardson, 2005). A blog is like a small learning community (Efimova and Fiedler, 2003). Members tend to get more involved than they do in other pedagogic and Web-based environments, thus producing a stronger sense of community (Wenger, 1998a; Godwin-Jones, 2003; Efimova and Fiedler, 2003; Godwin-Jones, 2008).

3. Research settings and methods

Electric Cars – Now! is a collective venture aiming at making electric cars affordable for everybody. This open-source community was established in 2007 in Finland. The community webpages and wikis offer open-source blueprints for electric car conversion kits worldwide and leave the manufacturing of the kits to the markets. When this study was conducted, the community core consisted of a few individuals, while the active group totalled 27 members. The entity had a large number of followers, who were supported by many companies and organizations.

The qualitative case study was chosen as a research strategy (Yin, 1994). It refers to an empirical study which "investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident" (Yin, 2009, p. 18). This study follows the agenda described by Eisenhardt (1989, p. 534): "the case study as a research strategy focuses on understanding the dynamics present within single settings". This particular case was chosen because of its unusual revelatory value for a CoP that aims at creating a tangible innovation by using a platform that normally aims at intangible problem-solving (Eisenhardt and Graebner, 2007).

The data collection was conducted using method and researcher triangulation (Patton, 1990). Creswell (1994), who defines case study strategy within the framework of an interpretative paradigm, states that with a case study, a researcher characteristically focuses on a single entity or phenomenon that is bounded by time and activity and collects detailed information by using a variety of data collection procedures. Morrow (2005) states that using multiple data sources enhances the interpretive status of the evidence. At first, the participants were asked to write freely about how they initially became involved with the community, how they perceived the operations and functioning of the CoP and how they foresaw its future from both their personal perspectives and the perspective of the CoP. After a qualitative content analysis, the conclusions were used as a basis for subsequent data collection via personal interviews. Finally, a group interview was conducted using a focused interview method (Barbour and Kitzinger, 1999).

The adequacy of a sample size is relative in qualitative research, and no objective analysis methods to determine it exist (Sandelowski, 1995). However, while standardized methods

and guidelines are scarce, justifying the sample size in the same way as any other choices is relevant in all studies. Purposeful, criterion-based sampling was used (Morrow, 2005); that is, participants were selected to provide the most information-rich data possible. The interviewees had shared experience in regards to a particular phenomenon, and they all belonged to a core group in the CoP in question (Wenger, 1998a). Four interviewees, including three technology specialists and a community organizer, represented the heart of the community (Wenger *et al.*, 2002). Morrow (2005, p. 255) points out that it is irrelevant to evaluate qualitative study solely based on the number of informants, "as if sheer numbers are an assurance of the quality of the findings". She continues that numbers alone have little to do with the quality or adequacy of qualitative data, and particularly in an interview-based study, numbers mean little (Morrow, 2005). Instead, insights and their meaningfulness depend on the case and richness of the data rather than on sample size (Patton, 1990). Therefore, after the interviews were recorded and transcribed, the data were then reviewed systematically to understand the context of the study, followed by a thematic analysis with an aim of identifying, analysing and reporting patterns that formed themes within the data (Braun and Clarke, 2006). The approach at this stage was inductive.

In the analysis, themes were categorized considering the life cycle of the case CoP and the evolution of its operations. Particular attention was paid to texts that included descriptions about relations and dynamics within the group, and the role of ICT at each stage was analysed. The analysis combined individually produced texts and personal interviews with the group interview, thereby endeavouring to cover the more widely shared discourse pertaining to the CoP (Weber, 1990). In the next section, the empirical results regarding the life cycle analysis of the case community are presented. Along with the analysis, some quotations from the data are presented to provide a more vivid, collective picture of the construction of meaning. The authentic voices of interviewees help in clarifying the interpretations. All direct quotes are in italics.

4. Life cycle analysis

4.1 An early stage – motives and expectations

The initial interest was in descriptions regarding how the community started forming itself, and in particular, what motivated individuals to take part in it in the first place. From the individual interview data, four themes were identified describing the different motives for participation:

1. joint target of interest;
2. communality;
3. interest in joint action and motivation to create networks; and
4. the development of one's skills.

The first theme was explained in the individually written texts describing how individuals had a certain interest, even passion, which they soon discovered was shared by other people who became part of the community. They expressed how the idea appealed to them, depicting it as fresh, innovative and new:

> *We started asking people to join the mailing list and to generate ideas there. It gathered people with similar interest, people who got excited about the idea of an electric car.*

At the early stage, besides the sharing of a common interest, the sense of enthusiasm was important. One described it as follows:

> *I think at the early stage it was the reciprocal excitement and enthusiasm that was the driving force in the community as a whole. The passion for a cause, and the spirit was contagious.*
>
> *At the early phase, we were an enthusiastic, dynamic and multisector group of people who worked together for a common goal.*

Regarding the second to fourth themes, people were interested in joining with the objective to communicate and work with other individuals who shared their interest, had complementary skills and knew how to develop their own competencies. Respondents wrote about the perceived opportunity to network with new people, leading to the third theme, the possibility of synergy and thus of learning. Thus, the conclusion is that at the early stage, abstract issues such as spirit and human- and social interaction-related issues were strongly emphasized. These issues were described, for example, as follows:

> *People were the fuel. Sure, the technology was also there behind, but mainly I got a chance to meet a kind of people I would not otherwise have ever met.*
>
> *To me, it was mainly the sense of communality and togetherness.*
>
> *The community was a vital environment to develop one's skills and to create networks.*
>
> *I was expecting to learn a more electric cars . . . and doing a little bit of software for cars . . . I was expecting activities to be sauna evenings, like-minded people, exchange of information and learning new things.*

Among the active members, the factors identified were synergy and the results of group thinking rather than thinking alone. That created the formation that the participants adopted during the early stage of the CoP.

After identifying the motivations to join the CoP, several expectations were discovered among the participants regarding the future and achievements of the CoP. Based on the analysis, these varied expectations were categorized into the following five groups:

1. *Ideological motivations* – The objective was to contribute to something that would make the world a better place.
2. *Technical product* – For some members, the objective and thus the driver for participation was an interest in being involved in building an innovative, tangible product.
3. *Communality* – Some people used the community as a networking arena, where the objective was meeting people and making new friends – in other words, socializing.
4. *Advisors* – Some people believed that they had something to offer, but for various reasons, chose to remain outsiders and adopted an advisory role.
5. *Hang arounds* – Some members' primary goal was to observe the group and stay aware of its activities.

According to the analysis in this study, the realistic nature of the plans was vital to ensuring that people shared similar expectations, not only ideologically but at the practical level as well. To sum up, at first, a common interest was enough to hold the group together. However, it soon became clear that people were very different and that participation was based on varying motives and thus also that the expectations were varied. In consequence, the group, which at first had seemed very cohesive, started dispersing, and people started dividing into active and passive members. In the active core group, people became more familiar with each other's skills and competencies, and personal chemistry-related issues began to play an even more pivotal role. Interviewees stated:

> *Little by little, quite early actually, it became clear that the ultimate reasons to be interested in the project were very different.*
>
> *Everyone had his or her own starting points. In fact, we never even properly discussed precisely each's personal goals.*

To sum up, the data indicate that in the process of establishing a new CoP, a joint interest and a shared passion for the issue at hand – not prior familiarity with the other participants – are relevant. At the beginning, it is also crucial that someone takes an active role in the community. As for the nature of a CoP, the analysis reveals that a CoP was perceived as an attractive forum due to its non-bureaucratic and flexible way of allowing people to work

together. It was regarded as a type of forum which encouraged and enabled "out-of-the-box thinking and operations". At a personal level, it was also considered a forum which allowed individuals to express themselves in creative ways. However, the data are interpreted to suggest that the expectations should have been discussed openly and extensively at the beginning. This would have been particularly relevant in the case CoP, because, ultimately, it aimed at achieving a concrete goal, building an electric car. After the initial euphoria, developments in the later stage proved that this goal was not held in common, a factor which, in turn, resulted in a variety of problems, including issues with the functioning and effectiveness of the group.

The role of ICT at this stage was mainly to act as a medium for informing interested parties. To some extent, it was also used for sharing and refining ideas. However, it has to be stated that even though ICT's role seemed to diminish at this stage of the life cycle, it was still important; its use and existence upholds the core idea of COPs, that of openness and communality. It was also a crucial medium for contributors who were interested in the topic but who were not in the core group.

4.2 Maturing stage – role differentiation

When moving towards a maturing stage, the group started dividing into sub-groups playing different roles. The community was growing very quickly by collecting people in email lists and communicating by electronic channels. As long as this situation existed, the participants were equal. After meeting at a physical meeting place, the core group took form as they saw each other and communicated face-to-face. Those members who were not able to take part in the meetings and the construction of the vehicle dropped to the peripheral group and followed the work of the community through the virtual channels. Active members of the community stood between these two groups in their level of activity and involvement in the community work. The chemistry between individuals started playing a more significant role, affecting the dynamics within the group. Matters progressed, the dynamics changed and intra-group criteria were developed as a new set of standards for the entire community. Then the "roles and responsibilities" had to be delegated, which constituted a substantial change, because at the beginning, each member did pretty much whatever he or she felt best suited to, and now the tasks were divided on a different basis. One reason for this was that within the core group, people got to know one another and each other's strengths, while they also shared the idea of what the CoP was all about and what it aimed to achieve. Thus, the development of the community's participation was based on "new criteria", and the group became more aware of its "skills capital". They also learned what kind of expertise they lacked, and they then tried to recruit specialists to provide the skills missing from the community. During this stage, the activities of the community on the internet platforms induced some people to take additional roles in product development or in production itself.

In contrast to the first stage of the community's life cycle, at this mature stage, the participants' concrete efforts became more important from the group dynamics point of view. Moreover, having a shared interest was not the sole combining force.

From the point of view of both continuance and role differentiation, finding a physical meeting place seemed to play an important role. Its relevance is easily understood, as the case CoP aimed at building a physical product. The data indicated that concretely working together had a positive effect on team spirit, especially among the active core group that had established itself at quite an early stage of the community. These people worked for the objectives in a concrete way or assumed other key roles in the community's performance. They also became friends whose relationships were characterized by companionship and trust.

However, at this general stage, the openness and freely available information started to change such that it was no longer so open; a more distinct division emerged between openly shared information and information given to only a few.

Based on the analysis of the different member roles/involvement characterizations from all the texts, there were different ways to categorize the community roles.

The classifications divide participants based on their activeness or passiveness and differentiate between the core group and the "outer group" (the followers). These groups were explained as follows:

- *Practitioners* were people with mechanical and technical skills who actually built the car in a garage.
- *PR people* took care of publicity and spurred the practitioners.
- *Followers* followed the mailing lists and commented on their overall activities.

The practitioners were described as "our gang". This group was doing the practical installation in the garage:

> *That was like our gang, which is actually a hands-on there in the garage. Then there was the "PR" and encouragement group. And you handled all of the Finlandia Hall and all, like by the team felt that, wow, get over there and that's a wonderful thing.*

> *There were practitioners, and then there was the visionaries. Also we had followers, who followed it online, and comments on it from time to time. It can be said that there could be for someone who has never commented on any mailing list or then maybe once.*

The second group's role was related to PR and encouragement. It was typical for this group to participate through the internet with mailing lists, a blog and a wiki. They did valuable work in a virtual working environment to speed up the development and practical work, and they also fostered positive publicity for the community.

The community also had a third classification for the people who were neither *practitioners* nor *visionaries*. This third group comprised the *followers*, who followed the community online and posted comments from time to time. Followers were an important part of the community, because they were the single largest group of participants. Their importance stems from their wide connections outside of the community. Therefore, even though they were passive members, they read the documentation online and helped to spread the produced information and results of the community to their existing networks:

> *Some people came there just to watch what they were interested in happen.*

> *It was just then approved by the starting assumption that there was no reason to attend except that they had a common goal.*

> *It did not matter what one's worldview was or whether or not it fit exactly.*

On the other hand, the above quotations illustrate in the summarized data that the diversity of the CoP itself was welcomed and was considered a desirable thing, because the intention had not been to build a homogenous group.

The core group members began to organize themselves so that the best expertise was channelled appropriately and pushed the project forward. Although the entity started acting in a more organized manner, it is noteworthy that no hierarchical management system was established, though the core group continued collectively and unofficially to lead the community.

However, it was important that some sort of criticism regarding participation was involved. To think it over, what was motivating people to involve and give advices to the others, even the others had not yet expressed their skill level. Still, no one needed to be evicted from the community. These observations and experiences contributed to the construction of a core group:

> *The early stages of an enthusiastic and dynamic multi-disciplinary outfit that blew together and sought the same objective.*

Sentiment remained reasonably good for a long time (2–3 years); setbacks and delays could be overcome.

Three to four years after the "jacket was empty", several of us and the operation was scattered.

The community stood out as soon as a few players, which looked at "useful" in terms of his plans.

It is certainly not like to think that I would have joined the community only for selfish reasons, because the project implementation was also close to the heart.

I will try, however, a closer cooperation specifically the most know-how of its own with other people because you can learn from them the most.

However, it started to find out about the first year that all originally qualified contributed experts was not always unambiguously correct information, but there were a lot of hype, and outright ignorance of his own hide from, in some cases.

Four groups were also discerned, based on their respective degrees of activity: *activists, semi-active, hang arounds* and *outsiders*. From the viewpoint of the different roles, in addition to the creation of the tangible product, it could be concluded that the community worked on two levels:

1. *People*: Individuals, groups and the entire community.
2. *Performance*: The different ways of performing diverse tasks and the combination of expertise.

The participants were from all over Finland, and later, when the awareness of the group expanded via ICT, from all over the world. This generated the need for "new forms of work" such as information technology and the use of virtuality. As a kind of counterbalance to the text, the performance also appeared to be strongly etched in traditional habits. The interviewees felt excited that the work took place in several places, from the internet to the physical meeting place in the garage. In fact, they were very proud of their open innovation platform on the internet, where they were able to post all the interesting and important things in the community.

4.3 Investors and change in group dynamics

The analysis reveals how the group's decision to seek external funding made a crucial difference in its overall dynamics. The participation of external stakeholders led to at least two outcomes: the expectations and demand to obtain results increased, and the need for monitoring and reporting emerged. The outsiders' inclusion influenced a significant element of the original motivation: the freedom and informality of the community in action. At this stage, the original members started to pledge information and seek their own profit and ways to create and make their own business. When outside investors became involved in the CoP, the community's priorities also changed. Transparency became even more selective, and members of the community began wondering, consciously or sometimes even unconsciously, what information was worth in terms of money. At this point, information was no longer available to everyone via the internet tools.

The increasing degree of fragmentation was recognized; there was a lot of suspicion, mutual competition, fragmenting into schisms and shortage of skills. Members of the core group tried to change this unwanted situation and tried to make corrections without success:

Then when Ampeeri (company) tried to begin to own the community, it went to the unwanted direction.

So, then woke up in the schism within the Community.

Yeah, we did not have the kind of model and the competence to how this thing now taken care of. It is this open community by whom created a prototype and how commercialization is done now, that it goes fairly . . .

When some began to ask the drawings, for example, on the engine stand, Eki refused to produce them.

So because he had commissioned them by paying money.

One person pulled the pea in his nose and that's where we used a lot of time to discuss that, whether it's open or not it is open.

There were things that we were not prepared for. Yes, we went along to explore the Open Hardware from the Internet and how it works. But when we were not Open Source people already, so I'd say that it was the operating software-side of the familiar action.

Community members were not, by nature, open-source people, and they had difficulties in acting according to community principles. This was followed by the phenomena that confirmed the decomposition of the group.

4.4 The end of the (active) community

After losing the group dynamic, the community no longer met at their physical meeting place, and the conversion kit project was not actively taken care of. Community meetings turned to passive participation and were mainly propped up by the members who had already become friends during the early and maturing stages of community development.

Even though the community still exists, its purpose and nature has changed. It is currently viewed as a forum for discussion by interested parties instead of a community aiming at solving a concrete case. However, even in this form, it is perceived as important, creating a forum for keeping in touch with the hope of someone coming up with a new enthusiastic plan which might be concretized. At this stage, community members are more equal and operate more at the same stage, because they are all participating in this community work through virtual channels:

Community, in this stage, in practice, is in the non-operating state, yet still alive at some level. I understand that no one any longer seriously believe to the original 500 pieces of eCorolla conversions is possible, but the community has the same interest (electric vehicles) of people with "discussion community".

In the future, if any of the individual or the general desirability of a specific initiative not come from any inside or outside, even conversations can completely cut off, which would be a shame.

At the end of the life cycle, the metaphor of a "life support system" may be used to describe the role of ICT. By this is meant that it creates a platform through which people can stay in touch. It also helps preserve the information gathered so far. Even though the original purpose of the community was to produce a physical product, social media and other digital content play an important role in the continuity of the community. At this point, the electric car conversion kits and product development have been discontinued, but the community continues to live virtually. The community's strength lies in the fact that the people who were involved from the beginning have continued to maintain contact online. Their knowledge capital rose to the international level, and currently, the eCars – Now! community is global. This would not have been possible without knowledge sharing and communications over the internet. Like most communities, this community has mechanisms for community members to help each other solve everyday problems and share ideas. The eCars – Now! community focused on helping by creating forums like Facebook groups for people to connect across geographical areas and to decide for themselves what knowledge to share and how to disseminate good ideas to the rest of the community.

5. Lessons learned

This section concludes by discussing some issues that explain the changes in the group dynamics during the life cycle of the eCars – Now! community. There were some pivotal situations which caused big changes. The community was relatively successful and productive up to the point where they decided to adopt an external stakeholder. Although

the community was created with passion, they forgot many things that they should have taken care of in the beginning. The community was surprised by the expertise and money they required for product development and the need for a physical meeting place. One big setback was the lack of blueprints and design in the development process. These factors caused the community to disintegrate and thus prevented it from fully attaining its goals. If any of these people try to set up the community again, they should take care of the factors described in this section.

The analysis in this study suggests that at the early stage of a community, the plans can be somewhat random and even utopian, but when the community evolves, this uncertainty may become a problem. First, it affects the achievement of the actual, and in this case, concrete results. Second, uncertainty and lack of clarity dampen enthusiasm and motivation, which are of utmost importance for voluntary participation. When the operations evolved and the life cycle progressed, both the physical meeting place as well as personal interaction and communication became increasingly important. The human factors also become more relevant, including issues of chemistry between people as well as different skills and know-how. These issues are interpreted as being specifically relevant because the CoP in question aimed at achieving a tangible outcome instead of solving an abstract problem. Also, if a CoP needs external funding to achieve its goals, it can be argued that this will create a new situation which significantly affects its operations, and particularly the group dynamics. In this case, that change occurred in a negative way.

An additional interpretation is that the tangible product and the manifestation of plans were crucial in this case and simultaneously played an important role in understanding the evolution of this community's life cycle. Tangibility seems to acquire the following meanings from the data:

- it demonstrates the reality of plans, whether or not the goals are being attained; and
- achieving concrete results ensures the continuance of the community and affects motivation.

Finally, it is argued that in the early stage, the ideological basis of the group was openness. All information was available for everyone who registered on the community platform on the internet. This community worked in the mindset of open innovation. Technical documentation and all other materials were available for everyone in the community's wiki pages, which attracted many people who were delighted by eCars. Many advisors delivered technical information and good advice to the practitioners of the community through the platform. The hang arounds were also very well-informed during this stage regarding how the core group was working.

6. Conclusions

This research examined group dynamics in a CoP through a case study. According to the results, group dynamics seemed relevant in understanding why a CoP either maintains its vitality or dissipates. At a personal level, the driving force was individualistic motivation, and at the community level, its objectives and goals were the driving force. Shared interest was also a combining force. However, shared interest was affected by conflicting motives and the realization of plans, by the pace at which the CoP evolved and by the sense of communality.

The role differentiation really began when the physical meeting place was brought into use. It more clearly reinforced the shaping of the core group, actives and peripherals, because part of the community had face-to-face meetings and the other part only participated over the internet. After investor inclusion, the knowledge was no longer accessible through the internet. This caused an inequality between community members in the physical meeting place and in the virtual channels and therefore affected group dynamics. Adopted roles in the community were also reflected in the group dynamics, while different stages of the community's life cycle affected the motivations which bound the group together.

This life cycle analysis revealed four themes that explained the change in the group dynamics and the dispersal of the community:

1. differentiation and dispersal of interests;
2. growth that resulted in role differentiation;
3. virtuality in community development; and
4. inclusion of investors.

The case community operated not only with knowledge, but also with a tangible product, a fact which is relevant to all of these themes. Therefore, the conclusion is that the tangibility of a problem to be solved seems to play a pivotal role in a CoP's operations and dynamics. As a result of a tangible objective in the case study, outside investors were included in the operations. The interpretation in this study is that if a CoP needs external funding to achieve its goals, it creates a new situation which significantly affects its operations, particularly the group dynamics. Finally, a CoP's group dynamics and cohesion are reinforced by shared interests and are weakened by goals set by external stakeholders. Such goals affect the members' roles, thus undermining the CoP's original idea.

At the beginning of the life cycle of the eCars community, ICT played a significant role. It helped increase awareness of the community in the first place and enabled people to join in, which thus enabled the community to evolve. When the operations evolved and the life cycle progressed, both the physical meeting place as well as personal interaction and communication were emphasized and became much more important. In the maturing stage, the role of ICT, and especially social media, was the essential part of the community.

The current study paves the way for further research. According to Eisenhardt (1989), the aim of this type of case study is to build new theory and suggest testable propositions for further research based on in-depth case-based analysis of the subject, in this instance, of a single case (Hoon, 2013). This kind of approach holds value in improving existing literature and fostering it with new knowledge by identifying and introducing new theoretical insights (Piekkari *et al.*, 2009; Birkinshaw *et al.*, 2011; Hoon, 2013; Reddy, 2015). While a single case itself is not of interest, its value is based on the abstractions, that is the conclusions and transfers that can be drawn based on the case.

In prior studies, the CoP group structure has been studied, for example, through roles and status differentials (Jex and Britt, 2008), and Wenger *et al.* (2002) have identified three main levels of community participation. However, the present study also identified different ways of characterizing community participation, which is also relevant from the group dynamics point of view. Thus, the topic should be studied further. Group dynamics in general, as they relate to the success of CoPs, should be also investigated further. Additional studies should implement the inclusion of external resources in the community. Further research is also needed to investigate tangible and intangible outcomes achieved through CoPs. Much of the available research was conducted over short periods, so prolonged interactions in a CoP context could show different results.

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