From Virtual Teams to Online Communities:
Fostering Group Based Collaboration for Innovation and Knowledge Management

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Abstract
This paper contrasts the characteristics of Virtual Teams and Online Communities with regard to their potentials for fostering Open Innovation Management. We develop scenarios to illustrate the potentially most effective usage for Virtual Teams and Open Innovation Communities in an enterprise and analyze how discontinuous innovations are developed in an open company environment. Core values, which should be taken into account when creating and operating a community effectively, will be identified and classified. To enhance and transfer our findings, we used semi-structured explorative interviews with practitioners engaged in the field of Innovation Management.

Keywords: Collaboration, Open Innovation Communities, Open Innovation Management, Virtual Teams

1. Introduction
Over the last years we have watched an opening of the Innovation Management in enterprises, which led to organization-spanning innovation activities. In recent literature this phenomenon is described as Open Innovation (cp. [3], [28], [34]). There are multidisciplinary roles and actors involved, having a strong need for coordination and collaboration, to lead an idea towards an innovation. Developing the ability to effectively collaborate becomes even more critical, as we continue to move towards a global, knowledge-based economy (cp. [16], [21]). While research has given details on Virtual Teams (VT) (cp. [23], [27]) and their processes, there is little literature on Online Communities, especially those dedicated to the innovation environment. To bridge this scientific gap and to help designing more effective business applications, we analyze how Virtual Teams and Online Communities can be used to foster the development of discontinuous innovations. Therefore we address the following questions: Which characteristics do discontinuous and Open Innovation show? Which potentials do Online Communities, especially so called Open Innovation Communities (OIC), have in comparison to VTs to leverage the development of these innovations?

To reach this goal, we describe in the beginning the innovation environment, where we focus especially on characteristics and arising requirements of discontinuous and Open Innovation. Subsequently,

Social Software is described briefly, as it is a class of technologies and applications, which might leverage the collaboration of individuals and groups. Based on existing literature we point out characteristics and processes for Virtual Teams. Afterwards the concept of Online Communities is introduced and illustrated, based on the characteristics of existing platforms and the values of real-world Open Innovation Communities. Based on explorative expert interviews we discuss different scenarios, in which OICs might leverage innovation effectiveness, if they are used in extension to VTs. This paper ends with a conclusion and an outlook to future fields of research.

2. Basic Concepts
In the field of Innovation Management several requirements increase the necessity of a new Online Community approach in addition to Virtual Teams. Social Software is introduced as a class of technologies and applications, which might enable these new forms of organizations.

2.1 Innovation Management
The creation of new ideas and their implementation as economically valuable innovations can be considered as core challenges to all enterprises. The reasons therefore are rooted in technological change, which causes shortening product lifecycles, the individualization of consumer demand, as well as the globalization of competition and enterprise networks (cp. [2], [22], [24], [28], [32]). Innovations can be implemented in products or services as well as in processes. Process innovations often refer to efficiency improvements and cost reduction (cp. [28]). Our research is primary related to product and service innovations, which enable enterprises to reinvent, diversify and adapt themselves (cp. [25], [30], [33]). We are especially interested in supporting the development of discontinuous innovations, which provide a comparably high return on investment (cp. [31]). Furthermore this kind of innovation projects has some significant characteristics and requirements. Discontinuous innovations are characterized by a high technological and target market uncertainty, a long duration – often 10 years and more (cp. [29]) – and high expenditures in research and development. Further uncertainty and risks arise from the often unknown time to market

and market research, which is mostly limited to qualitative data (cp. [8]). As [29] found out, discontinuous innovations have a higher degree of context sensitivity, as shared stories, experiences, enterprise culture, personalities and informal networks have a high influence on project success. They also point out, that innovation processes in this field are not linear (cp. [19]), rather sporadically and affected by stops and gos, where random changes in the environment and changes in the operating personas have high influence. Especially in this soft and informal environment, we see huge potential for Online Communities and their support through social software. There are often "[…] no clear rules […] high tolerance of ambiguity […] fuzzy, emergent selection environment […] weak ties and peripheral vision important" ([26, p.181]). Some of these challenges can be overcome by communities and other Social Software applications like wikis and blogs, as they increase context sensitivity and awareness of the participants (cp. [13]). Although it is significantly difficult to integrate customers during research and development, there is grave extend, to which they have to adapt their attitude, behavior and competencies to use the innovation. Taking all these factors into account, discontinuous innovation projects resemble more a trial-and-error-process (cp. [8]), than a Stage-Gate process (cp. [4]). Generating and developing ideas and innovations within an enterprise is not enough anymore. Rather companies have to extend their innovation process, in order to use internal and external sources for idea creation as well as internal and external ways to commercialize innovations [3].

2.2 Social Software

Since Social Software summarizes new applications and technologies, building a basis for many virtually executed collaboration processes, it is necessary to get an idea of what this buzzword really is about. An examination of scientific literature indicates that there is a general understanding in the core definition, with some small variations. For this paper the proposal of [18, p.1] forms the basis of our understanding: "Social Software is software that facilitates social interaction, collaboration and information exchange, and may even foster communities, based on the activities of groups of users. In its broadest sense, social software includes any software tool that brings people together and 'supports group interaction'". The communities mentioned in the definition above are shaped due to shared enthusiasm of their members, which can be related to interests, affinities, hobbies, professions or friendships. Real-world and virtual communities bear resemblance to a certain extent, since both are aimed at building a social network. The internet facilitates this task, as boundaries of geography and time become bridgeable or might even disappear

entirely. It is easier to contact people, to stay in touch with them, to further enhance a relationship and even to break a tie (cp. [11]). Social Software can be found both in private and in business environments. Since this paper aims to offer ways how a specific application type of Social Software, namely communities, can improve Open Innovation in enterprises we focus on business applications. Collaboration tools, known as Groupware or Computer-Supported Cooperative Work (CSCW), have been well-established in companies for a long time to support team collaboration. These collaboration tools, however, are different to Corporate Social Software since they are affected by a top-down approach whereas Social Software incorporates a self-organizing bottom-up approach (cp. [13]). Groupware is used in a predefined, compelled and well-defined organization and predefined teams. Corporate Social Software has a wider range of application and contains tools for communication, collaboration, tagging, social navigation and networking. Corporate Social Software is expected to have the most positive impact on knowledge management and collaboration (cp. [14]). Companies hope to convey the success of wikis like Wikipedia or widespread blogging applications to corporate knowledge platforms which enable employees to organize knowledge and to generate new ideas (cp. [6]). However, most companies still lack proper strategies to exploit this new resource (cp. [5]). Virtual Teams and Open Innovation Communities appear to be promising instruments to unlock this untapped resource.

2.3 Virtual Teams

As illustrated above, Innovation Management is a highly multidisciplinary field. To develop a holistic collaboration support concept for people engaging in this environment, we analyzed Virtual Teams to identify their characteristics and processes.

Literature has recognized over the last years that there actually aren't teams that work exclusively virtually or exclusively face-to-face as it is hardly possible to find a team today that does not use e-mail and other collaboration tools (cp. [23]). Since then research has concentrated on the extent of a team's virtualness (cp. [12]). However, VTs have got some core characteristics that make them distinguishable from traditional face-to-face teams. By definition, members of VTs are typically geographically dispersed and therefore rely heavily on IT to communicate and collaborate (cp. [17]). According to [23] the degree of IT usage is varying and the boundaries, which VTs have to overcome, may also be temporal or relational. In order to meet the requirements of specific tasks their composition is often very flexible and team members are drawn from different departments or even different organizations. Usually VTs consist of a limited number of members who know one another personally. Members bring in different skills, knowledge and abilities which lead to interdependency in their tasks. Despite their

flexibility, roles in VTs often represent traditional corporate hierarchical structures including a team leader and several collaborators who share responsibility for their outcomes.

The Input-Process-Output framework (cp. [15]) provides a structured approach for analyzing VTs. *Input* factors are distinguished in individual-level factors, group-level factors, and environment-level factors. Individual-level factors consist of factors such as personalities, knowledge, skills, and abilities. The structure of the team, the level of cohesiveness, and the group size define group-level factors. The environment-level factors are affected by the assigned task itself and its compatibility with virtual teaming and the corporate reward structure. *Processes* are intended to describe how teams achieve their outcomes. Therefore [20] distinguish two types of processes: socio-emotional processes and task processes. *Socio-emotional processes* focus on relationship building, team cohesion and trust (cp. [27]). VTs communicate and collaborate mainly via IT what might handicap members to relate to one another. To overcome this downside of the virtual environment, it has been suggested that face-to-face meetings in early project stages foster the ability to form closer relationships between team members (cp. [16]). If it is not feasible to meet face-to-face, there should be other possibilities to exchange experiences and other informal information. It would be conceivable to institute chat sessions or virtual coffee breaks (cp. [16]) on a regular basis. Team cohesion "[…] refers to member's attraction to the group and to its task" [23, p.816]. This is why cohesion has great influence on individual satisfaction and is a prerequisite for effective communication and information exchange (cp. [7]). Trust is another important aspect of the VT because it is crucial for the successful completion of the project. Since many VTs are short-lived, trust has to develop quickly. Early face-to-face meetings can as well contribute to a foundation of trust among team members and group cohesiveness (cp. [16]). [27, p.10] found that "virtual teams that exhibit high trusting behaviors experience significant social communication as well as predictable communication patterns, substantial feedback, positive leadership, enthusiasm, and the ability to cope with technical uncertainty." *Task Processes* include communication, coordination, and task-technology fit. Communication is one of the most important aspects for VTs and might be challenged by time delays, lack of a shared language, reduced social context cues, and weaker communication media (cp. [27], [23]). Leadership is important to initiate and to encourage effective communication (cp. [1]). However, [20, p.67] show that "[…] a high frequency of communication (more than a necessary minimum) tends to decrease the creative performance of innovation teams." The compatibility of technologies used by the Virtual

Team and the specific task it is about to work on is called task-technology fit. It is important that team members adapt to the new technology and team form. Recent studies found face-to-face meetings and phone calls to be best fitting for uncertain tasks, conflict management, idea generation and strategic decisions. IT-enabled communication, though, seems to be well suited for routine analysis and project status checks (cp. [27]). Considering a team's *output* research has tried to evaluate different measures of performance such as decision quality, number of ideas generated, and time it took to reach a decision. Besides these task-related aspects, satisfaction with team experience was also considered. In comparing VTs to traditional teams, results were ambiguous. While some studies stated the predominance of traditional teams, others found the contrary (cp. [23], [27]). More agreement was observed considering the factors that contributed to the successful performance of a VT. "These included training, strategy/goal setting; developing shared language, team building, team cohesiveness, communication, coordination and commitment of the team, the appropriate task-technology fit, and competitive and collaborative conflict behaviors" [27, p.13]. Results were analogically ambiguous for the assessment of member satisfaction. One finding that should be remembered is that team members were more likely to be satisfied if they have been given adequate training and used multiple communication methods (cp. [27]).

2.4 Open Innovation Communities

Online Communities constitute a particular specification of Social Software which can be found both in private and business environments. Users of private networking platforms like Facebook or LinkedIn and collaboration efforts like Wikipedia interact, collaborate and share information voluntarily creating huge knowledge pools. These platforms serve as role models for business applications, so-called Open Innovation Communities. In contrast to Virtual Teams' rather rigid structures, communities incorporate the openness needed for innovative ideas to come up and the environment for collaborators to conjointly further develop their inventions. The following paragraph is intended to give a short overview of the characteristics of OICs and of the analysis of existing communities. The concept of OICs can be applied in different contexts, e.g. internal to the boundaries of a company, external as a platform or as a business model itself. Hence, it is important to get clear about the general characteristics of these communities. OICs consist of a varying number of members with a collective vision but not necessarily similar backgrounds. They are rather formed via a shared interest in a certain topic. Their collaboration is primarily based on the usage of IT and their members strive to reach an individual goal by sharing information, ideas and work (cp. [10]). Typically,

they are built and maintained by a bottom-up approach. In contrast to VTs, which are mostly set by hierarchical decisions, members decide autonomously to join an OIC. People's choice to work in an OIC is expression of having stock in a certain area of research or work. Collaborating in communities users are trying to supply a want or to earn appreciation by other members through useful contributions. Interactions are predicated on implicit assumptions, rituals, protocols, rules and laws forming a common culture. Given that OICs consist of a large number of individuals these general principles are of particular importance (cp. [13]). As mentioned above OICs can be established as company internal platforms in research and development for geographically dispersed knowledge workers. This way, companies set up a platform for highly motivated employees to express and collectively develop their ideas. Not only members of R&D departments should have access, but employees from other departments as well (cp. [1]). Companies usually provide employee suggestion systems for internal idea generation which should be further developed. Employees should be given instant feedback and should have knowledge of the stage their idea is currently in. In the context of Open Innovation companies discovered the necessity to integrate additional stakeholders in their idea generation process. Customers, consumers and other external interested parties should be offered a hands-on platform to express their requirements, suggestions and complaints. In doing so, companies are able to meet customers' needs, infuse external knowledge into the organization at low cost and even potentially enter new markets. A third form of OICs is what we call innovation services. These services range from so-called brainstorm-rooms to intermediary platforms that link innovators and companies. Companies can post problems they are trying to solve and offer rewards for solutions. Another model is that innovators publish their concepts and the platform operator supports to find a company that is interested in bringing the invention to market.

In order to verify the theoretical considerations and concepts we conducted an analysis of existing OICs. Clustering these websites according to the intention and context we identified three major categories: first, platforms offering innovation services such as intermediary platforms or other innovation-related services; second, platforms focusing on product ideas and product design as corporate platforms; third, platforms supporting research activity on the Open Innovation paradigm itself. Each analyzed website is attendant to at least one category. Of particular interest for this paper were innovation services and corporate platforms since we are trying to evaluate how OICs can foster the development of innovations. Despite the fact that all of these websites harness collective intelligence their business models are quite different. Intermediary platforms provide a space to

bring companies and innovators together. Either companies can post problems there which innovators try to solve afterwards (cp. Innocentive), or innovators can present their ideas hoping to attract a company as realization partner (cp. Big Idea Group). Most of these platforms are operated by for-profit organizations that claim agency fees or a share of the royalty fees. Another direction of innovation services are services that support companies in better understanding people's behavior (cp. Sense Worldwide). Based on these insights companies can innovate and adjust their businesses, products and services. Therefore they use networks of so-called sensers. These are people having specialized knowledge in certain areas which enables them to identify or even set future trends. Company platforms for consumers' product ideas are intended for monitoring customers' wishes or even as new business models. LEGO-company offers a community site to its passionate hobbyists, where they can submit ideas for new models and even order the bricks needed to build their customized models (cp. LEGO FACTORY). Finally, websites, contributing to the Open Innovation paradigm itself collect and aggregate member-created content on recent trends and technologies (cp. Open Innovators, UC Berkeley Center for Open Innovation) Considering governance in existing OICs, we found a continuum ranging from primarily self-organizing (cp. BrainReactions) to rather rigid moderation and process-oriented approaches (cp. BMW Customer Innovation Lab, DELL Ideastorm). The number of members varied from a few hundred to more than 100,000 (cp. Guru, Innocentive).

3. Research Method

To gain insights in the innovation processes and established support for Virtual Teams, we analyzed 48 case studies and scientific literature. In addition we reviewed 71 websites, analyzing how Online Communities are implemented for Innovation Management in practice.

There is little scientific literature on OICs and their collaboration support, because of the novelty of these phenomena. Hence, based on the grounded theory (cp.[9]), we used 11 explorative, qualitative interviews with practitioners, representing 3 enterprises and being engaged in trans-sectoral innovation projects, engaged in innovation management, to establish first insights. The interviews were conducted face-to-face as well as via telephone and lasted in each case from 30 to 90 minutes.

4. Results and Discussion

Even though OICs bear resemblance to VTs there are some significant differences (see Table 1). It is important to consider that the characteristics displayed are not intended to be rigid but rather resemble a continuum depending on the situation. VTs rely on Groupware and other computer-mediated communication and collaboration tools. Being primarily used for projects that are engaged in

later stages of the innovation process, team members are working towards a common goal on an assigned task sharing responsibility for outcomes. Team members are often forced to join the team and roles resemble regular hierarchical structures. Since the number of members is limited, members develop strong ties and personal relations. OICs, however, communicate and collaborate primarily via Social Software using scale-free internet platforms. This is why they are mostly characterized by rather loose and informal network structures which are formed by interested collaborators on a voluntary basis. Members share interest for a certain area but pursue individual goals by participating. This platform-based approach leads to a democratic and meritocratic way of governance. Tasks do not need to be assigned but emerge and are shared rather naturally. Considering the innovation process, OICs can be found in early stages producing mostly collections of requirements and ideas or at most prototypes of new products, processes and services. Leadership in OICs is earned through intense participation, know-how, trust and motivation. "Roles and responsibilities of each member are clear to all, with no need for lengthy coordination meetings" [10, p.24].

Table 1: Comparison of Virtual Teams and Open Innovation Communities

Criterion	Open Innovation Community	Virtual Team
Formation	bottom-up / voluntary	top-down / forced
Goal	individual goal / shared interest	common goal / shared vision
Governance	democratic	hierarchical
Means of communication & collaboration	social software	groupware
Number of members	unlimited	limited (4-8 members)
Organization	self-organized	moderated
Responsibility	individual	shared
Suited stage in innovation process	early stages	subsequent stages
Task	voluntary	obligatory
Ties	weak / informal	strong / formal

Based on the OIC-characteristics, we discussed a variety of scenarios, how OICs might foster Open Innovation Management for enterprises. Especially the motivation of content production and the simplification, in respect to finding and organizing, fuel expectations of practitioners towards Social Software. The most promising approaches will be exposed in the following.

One interviewed company has already formed a department, dedicated to the observation of web-based trends and the development of early stage business models. Especially the observation of trends and the discussion of potential products and services could be supported via an OIC. To organize content, a platform, a wiki or a blog can be used. Furthermore, collective bookmarks and their aggregation in tag clouds can be used to visualize "what's hot". Given a proper rights and role management, consolidated trends can be

published to customers to strengthen interaction. Once a new product is developed, instructions, hints and experiences can be shared in a community. Lead user experiences can be integrated in an analogical way. Especially knowledge intensive and discontinuous products require high adoption of customer behaviour. Besides this know-how support, early stage customer satisfaction can be obtained. Established group specific information areas, e.g. developers, sales and services, could be linked via an integrated platform, to reduce repeated efforts in generating and updating. Whereas the scenarios described above aim to internalize external contributions from customers and partners, we could also identify a need for internal OICs. Internal communities are expected to share best practices and enable knowledge transfer on the overall process, which shall be achieved via a wiki or blogging system. We furthermore found a strong need for a common terminology in the innovation environment, in respect to products, processes, and ideas, which shall be based upon an interactive system within the organization.

For generated, non confidential ideas, a community can be established to discuss, enhance, and prioritize ideas.

Within the organization, an OIC can be used to link interdisciplinary actors and initiate collaboration, based on a shared information environment and profiles for further, team-based collaboration. The ease of use has been the most crucial point mentioned for a successful implementation.

As another result of our analysis of existing web-based communities, we found that values are crucial for a prosperous platform. The reason therefore might be seen in the more informal and loose network structures of communities. We identified and classified three major categories:

Trust and privacy
Trust provides a basis for any strong community, no matter if it is founded in real life or in cyberspace. Especially for usage and storage of personal data platform operators have to establish explicit guidelines that are visible to everybody. Privacy concerns have to be met by measures to guarantee data integrity that is to protect data from unauthorized access, to prevent theft, modification, vandalism, and deletion. Since OICs' attendants share valuable information and ideas, intellectual property concerns are likely to come up. Existing platforms handle this issue quite differently. Howsoever property rights are managed, platform operators are dependent on their members' confidence. Members should also be informed what data is to be circulated for advertising or other commercial purposes. Besides this legal information, there are other rules that can be explicit, e.g. such as admission process, rather informal or even implicit, like the so-called netiquette to foster courtesy in cyberspace.

Transparency

Internet users expect equality, liberality and transparency as inherent features of the internet. This is why operators should accept members as equal and let them participate in decisions to upgrade or change existing services. In case of conflict, operators should intervene quickly but from a neutral position.

Innovation and Image

The internet is changing so rapidly that successful OICs have to keep pace. The point is not only to further develop existing features, but also to integrate new features and to enhance ease of use. Innovation and quality contribute decisively to an OIC's image and determine significantly its success or failure.

5. Conclusion and Future Research

Open Innovation Communities show huge potential for developing discontinuous innovations. They support up to almost unlimited users – actually their value increases with each additional member – have a high degree of self-organization and everybody can get his say in-plane. By their nature, they form a context-sensitive environment, having fewer rigid structures than Virtual Teams. Applied to the innovation process they seem to suit especially early stages, where voluntary, bottom-up activities are appreciated more than in later stages.

There is a broad range of directions for future research about the role of communities in Innovation Management. First, researchers might explore how Virtual Teams and Online Communities open out to each other. Second, researchers might investigate the processes within communities more closely. Is the IPO-model (cp. [15]) modifiable and applicable for communities? Can organizational forms for communities, especially mechanisms of self-organization and moderation concepts, be structured and classified to understand these processes? Third, which technologies and applications can be established as standards, to enable an interoperability of different communities? Finally, there are privacy and security aspects connected with organizational networks and patent right issues, if a disruptive innovation idea is born in such a collaborative scenario. Trying to find answers to these kinds of questions can be a big deal for bridging natural barriers and designing suitable information and communication technology, leveraging intuitive and informal communication. We hope that our research will have a little share in attracting further research in this interesting and multidisciplinary field of research.

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7. References

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