

Social Networks as an Approach to the Enhancement of Collaboration among Universities and Corporate Research and Development

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Abstract Private use of online social networks is exceedingly popular. In business environments web services of such kind are not likewise exploited. Yet corporate online social networks do encourage socialization among co-workers and add value to a business. With regard to research and development such social capital gain may have immense positive effects on the innovative strength of a firm. Extended corporate networking with universities and affiliated research institutes seems obvious and beneficial. The intensive transfer of knowledge will not only co-ordinate market demand and theoretical findings but can also assist corporate and academic recruiting as both sides gain a deeper insight in the expertise of potential candidates. In this paper, we will introduce an online social network for research & development that helps to bridge the gap between researchers at universities and enterprises.

Keywords social networking, collaborative research, web 2.0, corporate R&D

1 Introduction

Existing offline social networks with regard to research and development (R&D) in the broader sense can be ascribed to personal relations that are long term built by means of conference attendance, workshop and working session participation. For incumbent members such offline networks comprehend substantial benefits. But in most cases these networks are specific to distinct scientific disciplines or topics and access is restricted. Apart from organizational structures hierarchical structures in these networks exist so that it is a long winded process for non-members to get involved and gain reputation with respect to both university and corporate research.

The disadvantages of the status quo are obvious: There is no transparency of content, research goals, R&D projects and membership. The focus on specific "popular" disciplines and markets can hamper an interdisciplinary selection of topics and cooperation beyond disciplinary constraints. And the distinct hierarchies may prevent auspicious, cutting-edge R&D projects to win recognition if they lack of support from longtime network members.

Some of these identified obstacles may be avoided with the setup of an online social network for research and development purposes. In particular this could advance greater transparency, lowered entry barriers and less hierarchical, more democratic decision-making structures in the research community.

2 Social Networks in Corporate Research and Development

2.1 Social Networks

For a further understanding it is useful to examine the social network as a social-hierarchical relationship structure of a social entity, either a single person or a group. Social networks are characterized by common interests of participants, a shared point of view and mutual trust. Socialization and exchange of knowledge and information are the primary purpose of such an adhocracy. Also psychological motives such as self-realization, self-efficacy and -recognition are to bear in mind. Social networks are organized as polycentric systems with lack of a central supervisory authority. The social entities are both cross-linked directly or indirectly per intermediary. The number of participants is time-variant and undetermined. Each single member as an elementary centre of coordination has limited influence, but together those members shape the network to a large extent.

Participants join a network on behalf of certain objectives, e.g. maintaining old and establishing new relations or for the exchange of experience and knowledge within a certain context, e.g. research. Closely linked to this initial objective are further interests, much more specific, such as given research disciplines and questions. Only because of these interests, the participants build relationships. In this respect, we speak of so-called social interest networks. With the combination of several interests such networks tend to cluster and develop substructures that stand out with a high degree of networking. The combination of interests can also be considered a specialization of interests. This may be due to a special aspect of research e.g. use of web 2.0 technologies for e-learning. However, complementary interests of different kind, will not lead to clustering, but may also shorten the communication distance among non-direct participants.

Hence social networks tend to be split, that is the participants are not all cross-linked. Both direct and indirect links exist. This facilitates the formation of cliques and subgroups with unequal power and hierarchical structures. This in turn is con-

trary to the assumption that web 2.0 and therefore online social networks are as a matter of principle strictly democratic.

In case of collateral communication via a common contact, an unmediated flow of information with regard to the intensity of communication might be more efficient and less noisy. Yet for the intermediary it may be significant, that the interaction among two participants involves him as a third party. In general the intermediary will attempt to remain the distance in between two participants in order to strengthen his own key position. Only in this form he can stay in control of communication and filter the flow of information.

A social network is subject to a continuous structural change. Thus, new relationships are established time and again and existing relationships are rarely suspended by participants. The degree of networking is dynamic. This means depending on the intensity of user interaction, relationships are strengthened or weakened until they are completely dissolved.

Furthermore the social network determines the collective consensus which has a great impact on the single participant. Values and standards are established by the community and projected onto the individual and thus influence his view to a large extent. At last, the individual subjective reality - not necessarily the perceived reality of others – is affected significantly by the individual interpretation of communication and interaction.

2.2 Online Social Networks

An online social network comprises several main features, which allow for users to: (a) Maintain a personal profile, (b) link the personal profile to the profile of others and (c) provide latter access to the individual one-level social network (without any mediator)

Numerous users are organized in online social networks. The personal profile page corresponds to the corpus of the online identity. As such it is the origin of all networking activities. It contains both personal and additional context-dependent data, information and documents of different kind. Users can control access to their personal profile and resources and may grant public or semi-public access. Hence only appointed groups of people may see the shared information and social resources.

Foremost online social networks reproduce existing real life social structures and relationships. Yet the latter may be expanded with regard to online networking. Concerning this matter two networking scenarios in respect of vested interests need to be distinguished: (a) Two users belong to the same social interest network that is peers with common interests. With the networking of both the social interest network is not expanded. Only the degree of networking is increasing and clustering may be visible (bridging of local structural holes). (b) Two users belong to separate social interest networks. With the networking of both, the social networks

are connected and new resources become available (bridging of global structural holes).

Subsequently the benefits online social online networks have to offer are elicited and discussed.

2.3 Use of Online Social Networks

The online networking of social entities, i.e. single users or groups, and henceforth the visible structure of entity relations, increases transparency in regard to resources available on the online social network. With the extent of such networks, additional resources become available and all participants may benefit. The visualization of direct and non-direct relations, guarantees that the new resources can be retrieved. Furthermore additional resources are made accessible with collaborative tagging. Moreover online social networks help to bridge the gap between two disjoint interdisciplinary social interest networks. These would have remained mutually hidden otherwise. Interaction with non-direct contacts at the edge of the social network or with participants of complementary social interest networks influences the own perspective and conception of considered issues in the field of research and education [1]. Moreover the use of online social networks boosts the interchange of thoughts [2].

The relations among participants are affected by informal communication. Thus online social networks in particular suit recursive genesis, advancement and dissemination of knowledge and information. The intensity of these processes is determined by the type of participant relations. A dense networking of participants therefore supports the reciprocal exchange of resources in general and knowledge in particular [3].

Online social networks are an appropriate instrument for the socialization of implicit knowledge resources. The transfer of such knowledge is of crucial importance to a society and its power of innovation [4]. Solely by means of personal relations, in learning or exchange processes such knowledge can be exchanged.

In this respect, both the unidirectional communication between individuals as well as the poly-directional communication in network-based research groups is particularly suitable. At the same time, the network as an efficient form of coordination, has been proven of value to organizations of all kind. Online social networks make communication and information hierarchies more transparent. Instead of mediated communication, now online social network participants, who have previously been invisible or have not been in authority, can be contacted directly. This increased transparency both in terms of visible networking as well as exercised research and development activities lead to improved coordination of the latter. The versatile and flexible structure can respond prompt to new coordination tasks [5]. And such a reciprocal knowledge process can encounter the increasing pace of innovation and pressure alike.

Another effect of social networking and socialization is the collective imprinting of norms, rules and expectations. In addition to the personal identity, the common norms can encourage trust. This becomes apparent if participants are addressed which are not directly linked or belong to a disjointed social network. However, the danger of false identities is present, but may be eliminated in a network of intelligentsia with scientific research as a common objective.

Regardless of the type of benefit, the network size affects the degree of benefit. But mere masses do not generate benefit and access restrictions may be reasonable. In our case we therefore address strictly academic and corporate research staff. In elite online social networks, the available resources can be controlled and organized more efficiently. Moreover, the level of socialization is higher which implies higher engagement.

A rule of general validity does not exist. In this context, just the critical mass is crucial. It is the minimum number of users, that is required to generate "a sufficient benefit from a long-term use" [6]. Hence participants join an online social network, if the subjective value dependant on a subjective critical mass is greater than the obliged costs.

2.4 Corporate Online Social Networking

Even in day-to-day business online social networks are an issue, but the corporate response to the socio-technical revolution differs considerably. In many companies online social networks are dismissed as mere gadgets, which just restrain the productivity of employees. Positive effects of increased networking and the value added seem underestimated and disprized, as to inter-company or external networking. However a few companies adapt to such a form of communication and advanced socialization, trying to fathom the latent benefits for the corporate world. In 2007 IBM introduced a companywide online social network called Beehive that employees were free to deploy both for operational and private purposes. IBM wanted to understand in which manner employees adopt and exploit a corporate online social network if they were free of constraints, that is without the dictation of management.

The functional scope of IBM's online social network is similar to that of known popular online services such as Facebook or MySpace. An employee may create a profile page with personal information that is linked to the profile pages of other users. Yet networking did not proceed as expected, because it was not bound to the immediate personal work environment, i.e. to the co-workers or the workflow-related contacts at other divisions.

The employees networked beyond their scope of work and connected to peers, which yet did not belong to the personal offline social networks. Employees at IBM also reached out to unacquainted colleagues rather than just co-workers they knew. Such an utilisation is much different from user behaviour on Facebook [7].

Concerning this matter, different causes are to be mentioned. In principle online social networking at IBM proceeds aside professional life on a private level among colleagues that share common interests. Still career aspects remain of importance. On this account the enhanced social networking prospects help to establish and cultivate new relationships that may be advantageous at a later stage of profession.

With regard to R&D corporate online social networking was of substantial interest. In terms of conducted R&D projects and R&D outlines executives tried to gain greater support, so others would bear the respective projects with individual resources such as knowledge, information and network contacts.

3 Status Quo in Research & Development

3.1 Overview

Enterprises are interested in new research results for their business. They are looking for experts and consultants who help to solve their specific and complex problems. Furthermore, they continuously need graduates that are well educated and prepared for the working life. Institutes associated to universities as well as enterprises have a continuous need for excellent junior scientists. Besides, they often need and use the given infrastructure of universities.

But above all, the current situation in the R&D community lacks of transparency. It is very difficult to find specialists who are interested and able to solve sophisticated and specialized research task within the vast scientific landscape. Although universities are interested in third party funds and enterprises are interested in cooperations with universities they are missing each other because of not knowing the other's needs.

Furthermore, the composition of existing networks often is not interdisciplinary enough. Some research tasks cannot be fulfilled because specialists of other disciplines are missing. Therefore, better research results are hampered because of a restrictive point of view.

Additionally, and despite the newest research results that are developed within universities the common situation in R&D often is antiquated. Often, many different information systems with partially out-of-date data are used. Therefore, it is difficult to receive the needed information. Or, some information might not be accessible for everyone. Because of this, the used data is managed twice, by that redundant and potentially contradictory. That leads to the fact that work is done twice and is more expensive than it could be. It is possible that two departments of the same university for example today are doing research within the same field. But because of a missing information system that supports exchange of informa-

tion between members of the scientific community, the scientists in charge often do not know each other. Therefore, synergetic effects cannot be gained.

Besides, the relations to enterprises often aren't managed very well. They are too loose so that the research may miss the practical relevance. The research in universities is often done too theoretically. Enterprises are interested in other topics or they are facing problems that are already solved theoretically, but are missing someone who can apply the solutions. But because universities are facing a reduction of financial resources, they depend on third-party funds received from enterprises.

For these reasons, R&D need an environment that supports them in their tasks: Networking between researchers of universities and enterprises. Over and above that, an online social network could be an approach to lower the entry barrier and to make information easier accessible. The inhibition to contact a person would be downsized because of the anonymity of the web and the exposition of interests by members of such an online social network in the scientific community.

3.2 A Short Study of Social Networking in Research

Although several online social networks exist we can observe that the scientific community does not participate very much. In July 2008, we have examined the use of online social networks like Xing, which is similar to LinkedIn, by scientists of the ten largest German universities. We have searched on Xing with various key words, describing the actual job of the scientist (e.g. Ph.D. Student, post-graduate, doctoral candidate, doctoral student and doctorand), in combination with the specific university and noted the number of registered members. This number is compared to the total number of scientific employees at these universities. An extract of the results is shown in table 1. Averaged, only 13.05% of the scientific university staff is organized online. We have to emphasise that the total number of employees organised in Xing may be greater as not every scientist may have a complete and correct user profile. But even if the correct number of organized employees is indeed greater we have to state that the online networking of the academic community is still at its beginning.

In the business world online social networks for communication, organisation and the transaction of services and information is unlike rampant. A recent study found 19% of all employees are participating in networks for professional matters. 2007 this number was but 15%. It is obvious that online social networking is of importance to companies [8] and adds value to their business.

University	Scientists	Members	Quota
University of Cologne	2077	447	21.52%
LMU München	3060	243	7.94%
University of Hagen	418	90	21.53%
University of Münster	3300	351	10.64%
University of Hamburg	3885	534	13.75%
JGU Mainz	2800	238	8.50%
TU Dresden	2611	149	5.71%
FU Berlin	2252	395	17.54%
RU Bochum	2530	340	13.44%
University of Duisburg-Essen	2830	310	10.95%

Table 1: relative degree of networking among scientists at major German universities

4 The Use of Online Social Networking in R&D

Corporate online social networks are beneficial to the different operational processes. With regard to a supplemental communication channel existent offline social networks are enforced because social structures at hand are institutionalized and the flow of information among networked employees is simplified. In addition an intensified networking can strengthen the allegiance to the company and increase the willingness to serve a higher corporate goal. Online social networks can also help to implement a more efficient project management with a much faster flow of information. Progressive networking and IT-based social browsing respectively eases access to other employees which are not yet part of the individual offline social network. With the enhancement of personal relationships bound resources, i.e. information, knowledge and contacts are accessible to a greater extent. Furthermore the experience of networking with hitherto unknown coworkers can increase the willingness to network on an international level and communicate with unprecedented people expanding the corporate horizon. [9]

As mentioned above corporate online social networks can strengthen the collective knowledge base of a firm. Systems of this kind form an alternative communication channel, which employees use to exchange thoughts and transfer knowledge. With a purposive expansion of the company borders and a respective incorporation of external research structures such as universities and affiliated research institutes, additional positive effects most notably in terms of research and development may be achieved. The networking of corporate and academic researchers results in a more sustainable matching of theoretical knowledge and practical use. Although science in its pursuit of knowledge should not be limited to such convenient requirements, a more intense alliance of both groups can help to contribute theoretical insights to product and service development without delay and cut innovation cycles. Networked social capital influences the innovativeness directly as well as the effect of knowledge transfer on innovativeness [10].

In general two forms of networking, i.e. direct networking and indirect networking via intermediary exist. The latter partial networking of network members leads to structural communication deficiencies. Concerning this matter local structural holes and global structural holes are to be distinguished [see Reagans and Zuckerman, 2001]. Both types impede the flow of information. The bridging of local structural holes within a group augments the degree of intergroup networking. The number of networked group members increases and the quality of intergroup relationships is improved. Thus project tasks can be coordinated and executed more efficiently. An across-the-group networking can bridge the global structural holes. Hence the exchange of knowledge and information between two or more workgroups will be intensified. This enables companies to react much faster to changes in their immediate business environment because the exchange of knowledge and information takes less time as mentioned before [11].

With regard to research and development the higher sustainability of contacts secures the long-term dialogue among enterprises and universities. Unlike conferences and workshops such a quasi-permanent exchange of thoughts simplifies the formation of research cooperations and assists to reach a successful conclusion in the end.

Online social networks set the stage for a permanent and comprehensive transfer of knowledge and information. With regard to the efficiency of communication occasional time-synchronous meetings or memoranda cannot likewise stimulate such processes.

In comparison to talks in passing thoughts can be elaborated, arranged and expressed in a more precise line of arguments, reducing the incidence of misunderstandings. Furthermore, the continuous knowledge transfer involves a reduction of innovation cycles and as a leading indicator raises the corporate awareness for technological progress and linked business opportunities. Due to the written form of online social networking the exchange of knowledge and information is documented and the respective corporate social memory can be accessed time-asynchronous. The high degree of availability increases the value of such information as all employees may benefit. The visibility of social structures and resources may reduce the response time and communication overhead. It is now evident which employee can provide relevant knowledge and information.

With regard to networking we may speak of social capital that adds value to corporate human resources. Access to such company-wide online social networks may assist the recruitment of high-potentials and experts creating a self-energizing effect as new professionals to the research and development department will add the value of their yet established offline networks. Corporate online social networking may lower the inhibition threshold to think and speak out of the box, which in turn improves the innovative ability and development of new knowledge.

Innovation can occur on two levels. The development of key technologies may be referred to as primal innovation which triggers the development of follow up technologies or so called derivative innovation. The use of online social networks can draw attention on primal innovations and inquisitorial work groups respec-

tively and may initiate further research and work on before mentioned derivative innovations.

Strict online social networking may be extended. Both online collaboration in wikis and collaborative tagging of resources can add value to a research and development network. Wikis are popular due to the ease of use and encourage separated people and groups to collaborate. As a matter of fact wikis are limited as to the given time asynchronism. Still they provide a platform to share (interim) results and discuss matters that are not time critical. Thus with regard to R&D wikis seem appropriate to knowledge development and management and are a functional add-on to online social networks. Yet wikis are often missing a reasoned structure. Even if a sophisticated one is given in advance, it is seldom kept by the user and is subject to constant change. Hence information retrieval in wikis is not efficient and cannot guarantee pleasant results. An approach to enhance search and resource browsing can be collaborative tagging.

Tagging is a prerequisite to a good topic related search as the relevance of a keyword is given by default if each information object is tagged. Therefore search can be geared to such tags and the search results are evaluated *ex ante*. As every network user is naming his scientific fields of interests and tags his own or bookmarked resources, e.g. literature, workgroups or contacts an efficient and much-qualified retrieval of information can be implemented.

5 Conceptual Design of an Online Social Network in R&D

5.1 Framework und Modules

An online social network for the R&D community should support the most important tasks of scientists concerning research and networking. Therefore, we can distinguish the following support modules: (a) The networking module, (b) the tagging module, (c) the project module, (d) the discussion module, (e) the literature module and (f) the evaluation module. Additionally, there are two basic modules that are linked to all other modules: (g) the user administration module and (h) the search module.

The user administration module is managing all these participants of the network with name, address, affiliation etc. The search module can be used in order to find key word related experts, contacts, literature, projects and discussions. Scientists are tagging their interests. The interests of scientists can be subdivided into research projects, research interests, desired contacts concerning other scientists and enterprises. The interests of enterprises are similar except for that they may not search for other enterprises to cooperate.

University and corporate scientists both can use the networking module. The relations are classified as pure academic relations between two university scientists and mixed relations between university and corporate scientists. That helps to

shrink the network to a pure academic network if desired. Further more, each relation can be classified if it is related to specific research projects etc. That helps to automatically classify the relevance of tags concerning relations, interests, re-research projects etc.

The project module can be used by university and corporate scientists. Within the module it is possible to describe and present research projects. They can either be finished projects the results of which are presented to others or the projects can be new ones. If a project is new it is possible to search for cooperation partners who can help within the project. For example a department wants to start a re-research project but cannot handle all research questions. Then this department can start a tendering procedure for those parts other partners should adopt. At this point a real globalisation of research is at its beginning. If partners are found, the project and its proposal can also be prepared via the project module. In order to improve research projects concerning the research questions for example it is possible to exhibit the project to the scientific community. Then the project can be evaluated via the evaluation module or it can be discussed via the discussion module.

Within the discussion module it is possible to discuss recent news and perceptions with other members of the scientific community in a faster and more democratic way than without such a network. New projects, research results, new ideas etc. can be exhibited so that their impact, benefit or quality can be discussed or evaluated by the collective.

Within the literature module each scientist can provide his publications to the network with adequate tagging. Then all other participants can search all publications via the search module. A publication can be classified by other scientist if the chosen tags are more or less relevant. Besides, a publication can also be evaluated concerning the quality of the publication, the content, the structure and the scientific procedure. That leads to a big database of classified and evaluated publications that guarantees a good key word related search.

5.2 Support Task

Because of the combination of tagging and online social networks additional functions can be provided. In order to support the networking task an automatic relation function can be implemented. Beside the relations between participants of the network we can establish a network of tags. That means that a virtual network is provided that connects participants with the same tags. Furthermore, several alert functions can be likewise implemented:

- Every time a new member enters the network with his own chosen tags other participants with the same tags are informed that there is a new potentially interesting contact. Additionally, participants can define relevant tags for this alert.

- Participants can observe others concerning their research results or publications.
- Participants can observe the publication list concerning specified tags. Every time a new publication is added with specified tags all participants who are interested in these tags are being informed.

6 Outlook

The proposed online social network for R&D may ensure sustainable coordination and cooperation among scientists of both university research and corporate R&D. Furthermore enhancements are conceivable.

Existing networks for students like Facebook can be linked for employment branding purposes using the open social API. Thus, students could gain a deeper insight in current research issues and the interests of firms.

In addition enterprises could source out research tasks to students who provide their labor and gain auxiliary credits. Therefore enterprises can get to know students as potential employees. Later on, when hiring new staff, for enterprises the risk of hiring the wrong candidate and for students the risk of choosing an inadequate employer will be significantly reduced. Using social and professional networks to scout for new sources of potential hires is even more “cost-effective, more pro-active and, ultimately [...] more productive approach” to recruitment [12].

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