Social Media Applications for Knowledge Exchange in Organizations

Requirements, Application, and User Acceptance in Industrial and Scientific Settings

André Calero Valdez[1], Anne Kathrin Schaar[1], Jens Bender[2], Susanne Aghassi[3], Günther Schuh[3], and Martina Ziefle[1]

[1]Human-Computer Interaction Center, Campus Boulevard 57, RWTH Aachen University, Germany
{calero-valdez,schaar,ziefle}@comm.rwth-aachen.de

[2]IntraWorlds GmbH, Erika-Mann-Straße 7, Munich, Germany
[3]Fraunhofer Institute for Production Technology IPT, Aachen, Germany

Abstract. With the broad success of Web 2.0, organizations have become interested in using social media for professional applications. To date related research has mainly focused on the social impact of social media. However, little is known about the circumstances under which employees will invest time in using social media, especially the perceived benefits and its barriers within enterprises need further research. Different aspects of organizational knowledge management bring along different requirements for social-media-based solutions. This chapter focusses on providing both a theoretical background on social media acceptance and concepts, as well as empirical findings from practice and research investigating acceptance-relevant needs and demands of social media users in different contexts. Findings from practice corroborate that the complexity of the plethora of communication paths can be supported by social media. Findings from research reveal that regarding the users' (emotive) needs is critical when dealing with sensitive communication/data. Combining both practice and research tries to bridge the knowledge gap existing in fast paced developments like social media.

Keywords: social media, knowledge management, technology acceptance, personality, user centred design, talent onboarding, technology platforms

1 Introduction – The Knowledge Society 2.0

Three societal changes concur that will have a huge impact on how well a society will develop – demographic change [1], tertiarization, and technological progress. All of them will impact how societies deal with knowledge exchange in an effort to attain sustainable knowledge of experts.

Demographic change Almost all big economies face the problem of demographic change. A large part of the workforce of an aging population is retiring, with a shrinking workforce supplying for the elderly part of the population [1]. Not only does this increase the burden on the younger part of the population to maintain a high tax volume to pay for pensions, the new generation will also have to acquire all business critical knowledge from the baby boomers before the cohort retires. Otherwise valuable intellectual capital will be lost with immeasurable repercussions on the revenue of enterprises.

Tertiarization In a time where the biggest part of revenue of first world economies is generated by service providers and the tools of trade all deal with knowledge, loss of knowledge is a dangerous threat to an economy [2]. Without the knowledge of experts, existing systems can not be maintained and will deteriorate. Furthermore knowledge is required during the process of innovation [3]. Innovations emerge when people combine their knowledge in novel ways. So knowledge becomes a critical factor for a region as a whole. Granovetter [4] proposed that the weak ties in a social network are the sources of information, innovation and, opportunity – a proposal applied and tested by Rogers in his theory of diffusion of innovation [5]. Knowledge in contrast to information is always in the head of some knowing person. Knowledge can not be copied, stored or retrieved. It must be exchanged, learnt, and communicated [6]. Thus tertiarization shift the nature of knowledge to a social one.

Technological Progress The development of Web 2.0, cloud computing, and modern Information and Communication Technologies (ICT) e.g. Smartphones have triggered new forms of communication and information interchange to emerge. Web 2.0 as a form of activating the end-user as a content generator has lead to a network of users, services and organizations. Processing power is always available because of ubiquitous computing. The users are always online and connected [7]. Beyond the user being constantly online, internet-capable devices and services are also constantly generating data. Big data is the emerging trend trying to facilitate these large amounts of data. Making all this knowledge and information available from largely unstructured incomplete data is a key driver of businesses. Social media can be used as a centralized means that builds upon all these technological advances.

1.1 Relevance of this Article

In a world, where the success of enterprises relies on their innovative capability and thus knowledge management, integration of communication into new forms of technology like social media is critical for the competitive advantage [8]. In this article three partners from relevant domains share their insights and research on how to successfully create a social media solution for knowledge exchange within organizational contexts.

IntraWorlds GmbH[1] is a provider of talent relationship management solutions, which include candidate engagement, talent onboarding, and active recruiting. The developed talent communities are being used by HR specialists to form ties with and acquire top talent from around the world. IntraWorlds are experienced with development and management of business related communities and bring in their practical expertise from industry projects. Offering hosted services gives IntraWorlds a unique insight into what makes community solutions successful.

The Fraunhofer IPT[2] combines knowledge and experience in all fields of production technology, such as process technology, production machines, mechatronics, production metrology and quality as well as technology management. The Fraunhofer IPT as a representative of RnD-services in applied sciences offers services for technology transfer connecting cutting-edge research and industry. In the context of this article they provide insights and research from how to use social media to foster knowledge exchange regarding technology.

The Human-Computer Interaction Center (HCIC)[3] is a research center of the RWTH Aachen University investigating the interface between humans and technology focusing on acceptance research and usability. An interdisciplinary team — encompassing fields from the social sciences, engineering and natural sciences — addresses questions of how cognitive, affective, and user diversity factors influence motives and barriers to use technology. In two research projects the HCIC deals with user-centered development of communities for knowledge exchange.

Emerging topics like social media are both currently industrially relevant and broadly scientifically unexplored. Therefore combining the knowledge from science, applied sciences, and industry ensures that results are both scientifically valid as well as industrially applicable and valuable.

1.2 Structure of this Article

This article is divided into four main sections. After the introduction the second section focuses on the special character of social media and its applicability for knowledge exchange in professional settings. Section three presents research results on how to apply social media for knowledge exchange in both industry and scientific settings. The last section provides a conclusion and highlights how insights from both industry and science can benefit from each other, thus giving translational efforts a vital and pivotal role.

Scenarios of Social Media Usage for Knowledge Exchange Since social media is a user-driven development usage motives might not carry over from the private to a work related settings unchanged. Work related settings are characterized by a diverse set of users, which can not just be employees, but also

[1] `http://www.intraworlds.com`
[2] `http://www.ipt.fraunhofer.de/en.html`
[3] `http://www.comm.rwth-aachen.de`

customers, colleagues, partners and possible new-hires. Each user group and usage scenario might have individual requirements for a successful application of social media.

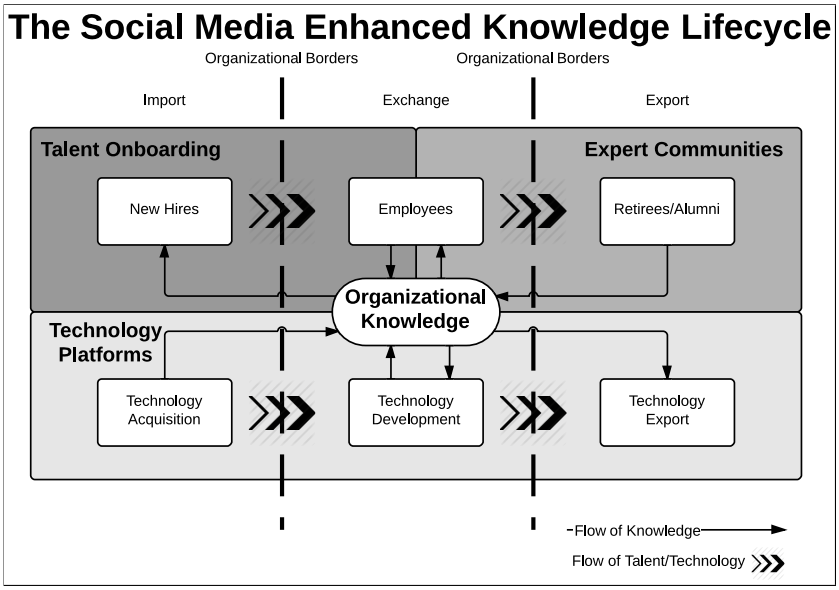

Fig. 1. Three roles of knowledge management in social media solutions. (Source: Own figure)

Social media is used in organizations in different scenarios, which applies to both corporate as well as scientific settings (see section 2).

Using social media in work contexts can have various characteristics, goals and challenges [9]. Basically two main alignments of social media integration into communication flows exist – the integration into *external* and *internal* communication matters. Albeit some solutions try to merge both internal and external alignments.

Social media platform solutions can have different foci (see Fig. 1) that are addressed in this article. It can focus on *company-to-(potential-)employee* communication (e.g. Talent onboarding see section 2.3), *employee-to-employee* as well as *company-to-employee* (Intranet-communities see section 3.2 and 3.3) and third *company-to-company* (e.g. Technology Platforms see section 2.4). All of them address different communication facets. Lastly *company-to-consumer* and vice versa solutions exist (e.g. Participatory Design, Open Innovation, Product Platforms, etc.) but are not addressed in this article, as they are instruments of marketing rather than of knowledge exchange. A case for these platforms as a means of knowledge exchange can be made, but is not a focus of this article.

To illustrate how social media can be integrated two exemplary cases were chosen for demonstrative purposes. The first scenario (see section 3.2) is a corporate platform for business internal communication with a special focus on business internal onboarding, knowledge management, and innovation support (i.e. a community for experts). For this example research results regarding requirements for such a solution are presented with a focus on etiquette needs and data disclosure dependent on user diversity factors. The second example (see section 3.3) presents a platform design for a scientific context. In large-scale interdisciplinary research projects similar needs for knowledge exchange exist, as such endeavors are comparable to businesses with business units. There we try to transfer the findings from the first example, by addressing users needs preemptively. In particular carrying over findings on data disclosure to the different context of scientific data (e.g. publications, patents, etc.) must be addressed as well as implications of interdisciplinary communication. In order to establish interdisciplinary knowledge exchange groundwork features must be lain out (e.g. project management, terminology management, technology transfer) to enable successful interdisciplinary cooperation.

2 Social Media Based Knowledge Exchange in Organizations

Based on newly available ICT,xw innovative approaches for strategic knowledge exchange are appearing in professional usage contexts. In the following subsections this phenomenon is taken up by working out the general characteristics of social media as a possible medium for knowledge exchange (see section 2.1). This section unites findings from practice with theory to establish the need for further research presented in section 3. Section 2.2 addresses the question whether social media can be a success factor for knowledge exchange. In this context both settings, which are relevant for this article (corporate and scientific), are portrayed according to the usage of social media. Following that, sections 2.3 and 2.4 are presenting two examples for social media usage in organizations from a practical point of view. Section 2.3 presents insights into the process of onboarding via social media. Section 2.4 deals with technology platforms, which constitute a social media enhanced approach towards technology transfer. Human factors that can determine success of ICT are elaborated in section 2.5. Theory background on technology acceptance is presented and related and extended to the specific "social" aspects of social media.

2.1 Social Media as a Medium for Knowledge Exchange

Social media incorporates many of the technologies that were previously already available as singular services. A typical Social Networking Site (SNS) incorporates services like a messaging system (e.g. email or chat), a publishing system (e.g. message wall or Blog), a portrayal system (e.g. profile pages), and networking capabilities (e.g. friending-system).

The networking component allows users to connect their profiles, query the online status of connected users and easily send messages to single or multiple users. By differentiating between a publishing system and a messaging system users can pick a communication channel according to the urgency, privacy, and importance of a message. How these criteria are mapped to the individual communication channels may vary between users [10].

Communication channels integrated into social media can be partitioned according to the aspects of synchronicity and cardinality (see Table 1). The functions supplied by these channels can be attributed to support participation, collaboration or communication. *Participation* describes the process were multiple external users can submit or discuss ideas that are put online for discussion. Participation explicitly invites members of the weak-tie network to help out by creating content for an internal group of some organization. In *collaboration* scenarios members from within a group are assisted by communication media that allow improved flow of information within groups both synchronously and asynchronously. Collaborative scenarios are characterized by a highly many-to-many flow of communication. *Communication* scenarios include all forms of cardinality and focus on transfer of information between individuals.

Table 1. Synchronicity and Cardinality of Communication Channels

	Synchronous	Asynchronous
One-to-One	Private Chat	Messaging-System
One-To-Many	Micro-Blogging, Social Stream	Blog, Profile Page
Many-To-Many	Group Chat	Message Board

2.2 Social Media as a Success Factor for Knowledge Exchange?

The benefits of social media could play a beneficial role in establishing sustainable knowledge management systems in organizational contexts. Based on the "Wikipedia-Trend" Wiki-systems emerged and have successfully penetrated the professional sector and were found to enhance reputation, make work easier, and help organizations to improve their processes [11]. But Wiki-Systems only provide a small proportion of "social" features that are available in public social networking sites (SNS) for example. As mentioned in section 2.1 there are many more functions that might be beneficial for organizational contexts. In the following two subsections examples from corporate as well as scientific settings are presented, to work out at which points social media could be applied as a success factor for knowledge exchange.

Corporate Setting While the impact of public social media on knowledge exchange has been investigated by Hemsley [12] (who also derives the need of firms

to become more "social"), corporate social media platforms and their requirements from a user's perspective have not been investigated thoroughly yet. To analyze the success story of social media in the working context two central questions must be discussed: *What makes these social media applications attractive for business executives today?* And *what are the prospected benefits of an integration?* In regard to these questions we can assume that the extreme (economic) success of social media applications (e.g. facebook, Twitter, Flickr) within the private usage context [13–15] promises success of business implementations of social media. Another reason is the shift from predominantly physical work to knowledge-based work, which made knowledge the central resource of economy within the western countries [16–18]. In this context, a systematic management of a company's knowledge became increasingly important and a necessary field of action in enterprises. Social media integration into the knowledge management process of enterprises is also recommended by the recent knowledge management literature, which welcomes the integration of human aspects into knowledge management affairs [8, 19]. Richter and Koch in this context also address the fact that the goals and ideas behind social media are highly in line with the goals of knowledge management [20–22], which makes a combination of both even more suitable and attractive for enterprises.

Prospected benfits of social media in a professional usage setting are the strategic support of knowledge management, knowledge exchange, and knowledge support within enterprises [19]. Especially the "social" aspects promise a shift to a user-driven generation of content.

Two examples for social media/network solutions available for business applications are Yammer[4] and Liferay[5]. Both solutions offer a broad range of social media features, which can be utilized to support knowledge management in corporate settings. Besides functions like document management and the option to create groups, especially groupware components like Wikis, forums, instant messaging, calendars, and the opportunity to make centralized announcements allow diverse forms of communication and interaction as well as the interlinking of content with users. This broad portfolio of different features offers the opportunity to create specifically tailored solutions with a focus on the respective user group. Thus social media promises to fuel the intrinsic motivation of people to participate and to overcome the known barriers of knowledge sharing and thus strategic knowledge management [23].

Science Setting As valid scientific knowledge about success criteria for social media usage in corporate settings is rare, the situation for social network use in science is even worse. Although social media solutions are quite prominent in research there is only little knowledge about scientific use and impact of user-diversity factors in this context. In 2011 Elena Gilia presented an overview of available academic Social Networks[24]. In this context the quite prominent examples ResearchGate, Acedemia.edu and Mendeley are presented.

[4] `http://www.yammer.com`
[5] `http://www.liferay.com`

ReserchGate[6] focuses on sharing information abut ones research interest and activities with other researchers. Therefore, it allows users to list the titles of one's publications, upload full texts, name research interests as well as search within the available material and other databases like PubMed, CiteSeer, arXiv. Additionally it allows to sign-in into virtual groups with special research interest or discuss topics in a forum. Beside the interpersonal knowledge exchange there are also opportunities that distribute information about events like workshops or conferences as well as a jobs section, where one can find information about open positions in research. Another project presented in Gilia (2011) is *Academia.edu* [7], which is comparable to ResearchGate, focussed on sharing and presenting one's research, as well as following other researchers within the same field. A third Social Network approach mentioned in Gilia (2011) is *Mendeley*[8]. Mendeley is a quite prominent online service for the management of references combined with a social network for academics. The Social Network integrated into Mendeley supports a upload of one's CV as well as presenting a personal profile with information about one's research interests, as well as current and future research activities, which can be searched by others. Comparable to ResearchGate, it contains a section for uploading papers. Additionally Mendeley offers community-forming facilities, which allow forming both private and public groups. This group section offers task assignment options for project planning, included in a personalized Mendeley Dashboard. In addition to the mentioned range of services, Mendeley also focuses on offering real-time insights into research trends. Therefore a matching of scholarly papers with your reported research interests, as well as statistics about the most prominent papers, topics, outlets, as well as authors within your field is given. Mendeley is also active in the field of webometrics/scientometrics by generating individual research impact data, which portrays information about how many people have read your article or downloaded it. This also provides the authors with information about their audiences' scientific background and country of origin. Summarizing we can say that there are different scientific oriented social networks available, which offer different facets of social media based services.

According to the focus of this article we can say that there is a trend to use social media in corporate as well as scientific settings. Nevertheless in both settings only little knowledge about criteria for successful implementation exists. To bridge and fill this knowledge gap section 2.3 on *Talent-Onboarding* and section 2.4 on *Technology Platforms* will present two aspects of social media integration from a practical point of view. In contrast section 3 will present a scientific investigation of social media integration in organizational contexts in two research projects.

[6] `http://www.researchgate.net`
[7] `http://www.academia.edu`
[8] `http://www.mendeley.com`

2.3 Talent Onboarding

An application area of social media for knowledge exchange that has become more popular with corporations in recent years is onboarding of new employees. First of all, companies have realized that in a world of scarce talent supply valuing and retaining talent and employees has become an important capability for long-term success. Additionally, technologies make it possible to shape the onboarding process in a way that makes it easy to handle and also financially very beneficial.

The onboarding process refers to the mechanism through which new employees acquire the necessary knowledge, skills, and behaviors to become effective organizational members and insiders [25]. Whilst today an increasing number of organizations is thinking about a more formalized onboarding process, this movement is still quite new. A recent study of the Aberdeen Group states that "only 37% have invested in a formal onboarding program for more than two years" [26]. Besides the two global aspects of talent scarcity and technological progress that support taking action there are four key drivers that push companies towards introducing systematic onboarding:

1. *Increase Productivity:* Structuring the onboarding process and handling it online reduces cycle times for documents and feedback loops from days to minutes. It additionally reduces costs and failure rates and brings new employees up to speed faster.
2. *Higher Employee Engagement:* In times of talent scarcity, providing employee engagement aspects is a main part of the onboarding process. Onboarding is a chance for making a good first impression and for welcoming a new employee as part of the corporate "family".
3. *Higher Employee Retention:* Analyses have shown that "86% of new hires decide to stay or leave a company within their first six months and new employees are 69% more likely to stay longer than three years if they experience well-structured onboarding."[27]
4. *Better Assimiliation:* Providing new hires not only with structured formal processes but also with information about their new social environment and workplace can be complemented with learning information. With systematic onboarding new employees can access learning materials even before actually joining and also in the first months of work.

Whilst main drivers for onboarding are quite consistent amongst corporations, the definition of the timeframe for onboarding can vary quite a bit between organizations. From a conceptual view the onboarding even starts before the new hires signature, namely when the new employee still is a candidate. Although the main process defined as onboarding starts with the new employee's signature and end some weeks or months after his first working day (usually 1-3 months, see also [26]).

Social media and social software can assist this process best when workflows connect not only two people but involve several employees. In these scenarios an "onboarding portal" or "private online community" is accessible to new hires

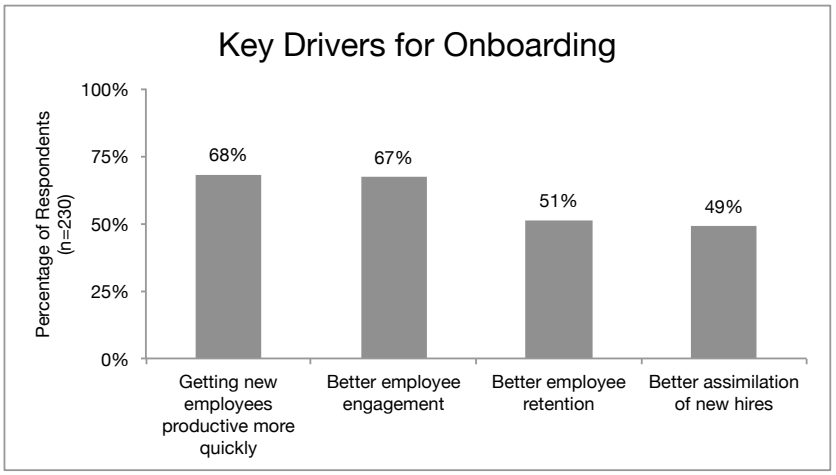

Fig. 2. Key drivers for onboarding according to the Aberdeen Group [26]

but also selected employees that have worked with the company for quite some time. In this onboarding community new hires can connect, share information, and build relationships with valuable hints from recent hires before even showing up for their first day of work.

This type of community addresses the first of the three roles of knowledge management (i.e. *import*) in social media solutions (see Fig. 1).

2.4 Technology Platforms

In this subsection technology platforms are introduced, which cover the second and third role of knowledge management in social media solutions (*exchange and export*, see Fig. 1).

Increasing technology complexity and rising efforts for technology development combined with shorter amortization periods of the developed technologies, intra- as well as inter-organizational technology transfer is once again gaining importance [28].

The intra-organizational perspective mainly deals with the question on how to get the developed technologies to an efficient use within the enterprise. The slogan "Technologies belong to the enterprise and products to the business units" shows the intent of companies, to reuse technologies in as many products as possible in order to maximize the technologies' exploitation potential [29]. This again leads to the next question, which is how technological knowledge can be made available throughout the (oftentimes regionally distributed) company? Modern ICT, particularly the intranet or web-based solutions can take a crucial role in supporting these activities [28]. The inter-organizational perspective of technology transfer mainly addresses the question on how to bridge the gap between research and industry. In order to stay globally competitive enterprises face an

increasing pressure to be innovative [30]. The rising complexity of new technologies forces enterprises into RnD-cooperations with third parties as technology development can often not be handled by one organization on its own. At the same time lots of excellent research results from academia remain unexploited. The reason for this often lies in a lacking industrial partner for commercialization of developed technologies, which again is often caused by lack of visibility [31].

In the past decade, the spreading of the Internet, faster Internet connections and more and more powerful web technologies paved a novel way for supporting technology transfer. Web-based portals (technology transfer portals) have proven to be suitable support instruments, particularly in the preliminary phases of technology transfer (e.g. in the identification and search phase) [32]. Especially social media approaches allowing the user and its network relations to take center stage might play an important role for the support of technology transfer in the future. Web-based technology transfer portals — i.e. social knowledge management systems dedicated to the support of technology transfer — offer great potential by bringing together technology demand and offer. Although the potential of social media for the field of technology transfer has been recognized, its application to this context has been very limited in the past [28, 33].

Analyses have shown that most of the existing technology transfer portals are run by a university or university network and comprise of functions, allowing technologies or technological knowledge to be displayed, described and offered to interested consumers and potential transfer partners. Prominent examples are the "iBridge Network"[9] by the US-Kaufmann Foundation, the "Research to Business Technology-market"[10] of the Karlsruhe Institute of Technology or the "EasyAccessIP"[11] Portal in the UK. The investigated portals provide the contact to inventors, technology owners and involved transfer mediators. Some even go further and support the actual transfer via predefined licensing forms and workflows. The way in which technologies are presented on the platforms varies from very structured approaches, including a short description, the technology readiness level and possible fields of application to more flexible forms, leaving more freedom to the technology provider. Furthermore, the considered portals show a differing range of application. Whereas some merely focus on technology transfer, others have a wider spectrum, such as the brokering of project partners or funding programs.

One research project where a technology platform is united with a organization internal knowledge management solution is the Scientific Cooperation Portal within the Aachen Cluster of Excellence (CoE) "Integrative Production Technology for High-Wage Countries" (see section 3.3).

[9] www.ibridgenetwork.org
[10] techtransfer.ima.kit.edu
[11] www.easyaccessip.org.uk

2.5 The Human Factor in Knowledge Exchange via Social Media in Professional Contexts

Understanding which factors are central for people in the context of using technology, is essential for any form of successful technology implementation within any given setting. Especially motives behind professional use of technology are of interest. In contrast to the private field, professional usage may not always be voluntarily but instead in most cases obligatory. This section portrays central theories and findings of technology acceptance research and works out the need to integrate the user's point of view into the design and realization process of technology in the professional context. Technology acceptance models have proven highly successful in predicting behavior in ICT settings, which occurred in the business world in the early eighties. But do these models fit to social media solutions?

The research field of technology acceptance originated from research in social psychology, when researchers tried to understand what factors influenced voting behavior and other forms of social behavior [34]. An early model for predicting social behavior is the Theory of Reasoned Action (TRA), which predicts an outcome behavior as a function of ones beliefs about the outcome of a behavior and its normative value.

In the technology acceptance model (TAM) behavioral intention to use an information system is predicted from two factors – compatibility and relative advantage (i.e. perceived ease of use and perceived usefulness). This led to the development of the TAM.

The TAM developed by Davis [35] and Bagozzi [36] has been called the most influential model in this research area [37]. It has been applied multiple times in different contexts and extended by Davis and others [38–40]. Venkatesh et al. [41] reformed the model into the Unified Theory of Acceptance and Use of Technology (UTAUT).

The UTAUT predicts behavior using four perceptions (see Fig. 3) about a system – the expected performance (i.e. perceived usefulness), expected effort (i.e. perceived ease of use), social influence (i.e. perception of a system in the peer group), and facilitating conditions (i.e. availability of support). These factors are moderated in regard to their importance by gender, age, experience, and voluntariness of use.

The question remains how these models can be applied to social media applications. Much of the explained variance in behavioral intention in these models relies on the usefulness of the proposed solution. In a social media application a lot of the benefit stems from content generated by other users, whose usage behavior again depends on the usefulness of the system — a cyclical dependency. Based on TRA models and regarding the use of information systems Hartwick found the influence of user participation and involvement to be substantial for their success [42]. Lurking users do not actively contribute to a system but do so out of a variety of reasons [43]. Besides good usability, the feeling of being a part of a community is a necessity to convert lurkers to participators, thus a

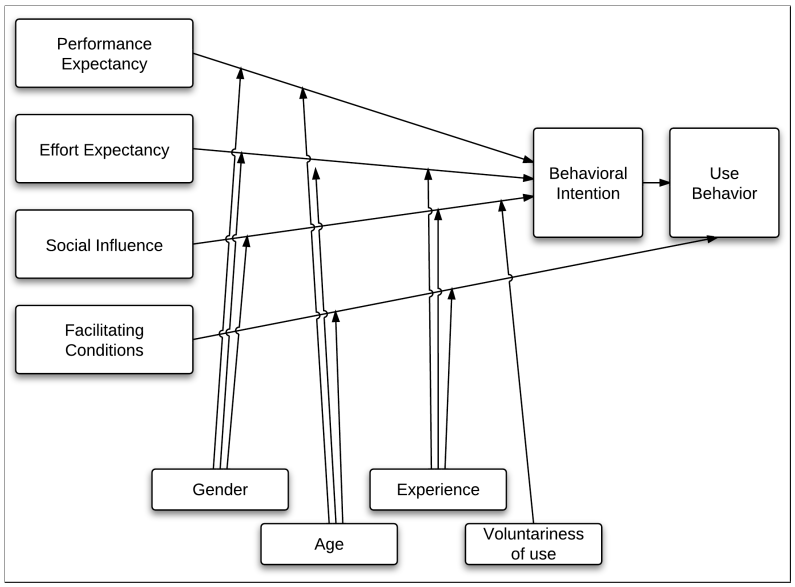

Fig. 3. Unified Theory of Acceptance and Use of Technology [41]

well defined community of active users is needed. A critical mass of users must actively use a system before it "takes off" and becomes a value on its own.

In order to get this critical mass to use a social media system it is necessary to integrate findings of public social media acceptance with the requirements of its professional use. Aspects of user diversity (e.g. personality, computer self-efficacy, age, gender) and in particular integrating the uniqueness of a company's culture into the system must be considered when devising such a solution.

Summarizing we can say, that when trying to design a social media solution for knowledge exchange one must keep the requirements of the users in mind. Firstly a user-centered requirements analysis must be performed in order to understand what makes a solution *useful* in regard to the user's everyday tasks. User-centered design and usability studies help to ensure the systems *ease of use*. Furthermore contextual constraints like aspects of *data security* or *customization* options should also be investigated to ensure that users feel safe and as part of a community, which in turn constitutes a big part of the *social influence* to use a system. A factor not studied for ICT is the influence and strictness of normative rules (e.g. what to share, how to behave) on the behavioral intention to use a system. In order to minimize barriers due to the communicative nature of social media we study the effect of some of these rules like *etiquette* and *data disclosure* and how their perception is influenced by user diversity factors.

3 Applied Social Media for Knowledge Exchange

As presented in section 2, social media applications can have different target user groups and purposes. In the following sections the results of two ongoing research projects are outlined particularly in regard to their impact on knowledge exchange within a corporate knowledge-intensive setting. Both projects are approached user-centered, so a focus is put on requirements for usage motivation and acceptance. In both settings an internal communication is addressed.

In the first research project called *iNec*[12] an expert community is developed with a user-centered approach (see 3.2). The purpose of this community is to secure knowledge for knowledge-intensive companies in order to tackle the upcoming consequences of the demographic change (see 1).

The second research project is a sub-project of the research cluster "Integrative Production Technology for High-Wage Countries"[13] called *Cross-Sectional-Processes*. This sub-project investigates the usefulness of knowledge tools in a research cluster setting, dealing with high staff volatility, speed of knowledge development and the need for high connectedness (see section 3.3). For this purpose a *Scientific Cooperation Portal* is devised integrating user profiles and knowledge output (i.e. scientific publications) visually. Furthermore the portal will be integrated with a technology platform (see section 2.4), a technology centered means of knowledge exchange, completing the social media enhanced Knowledge Lifecycle introduced in Fig. 1.

3.1 Methodology

The research presented in the following two sections uses both qualitative and quantitative methods. Both approaches are used repeatedly to triangulate the topic. As qualitative methods semi-structured double-interviews (two interviewees, one interviewer, N=7, 14 participants) and semi-structured focus groups (total of N=13 participants) were used. Participants were interviewed in a neutral setting, recorded, their recordings transcribed, categorized and then analyzed for frequency of categories. Participants were acquired through direct approach in the respective organizations. Controls were acquired through the individual networks of the partaking researchers addressing mostly people that fit the criteria of being an employed knowledge worker.

As a quantitative approach questionnaire studies were conducted (N=151, N=127, N=99, N=62). In most cases standardized item sets (e.g. Big-Five personality, achievement motivation, etc.) were used to ensure reliability and validity of measures. Where no standardized items were available, items were generated from qualitative data and assessed using six-point Likert scales.

Constructs where then generated using principal component analysis with varimax-rotation (verifying the applicability constraints: KMO-criteria for total

[12] "Innovation through Expert-Communities in the time of demographic change" `http://www.projekt-inec.de`

[13] `http://www.production-research.de`

and individual variable > 0.8, Bartlett's test of Sphericity $p < .05$). Components were extracted when Eigenvalues were larger than 1 and when factor loadings were larger than .4. After testing additivity (Tukey) additive scales were generated. Scale reliability is then reported as Cronbach's α.

As measures of interaction, bivariate correlations (Pearson's r or Spearman ρ) and multiple linear regression analyses were performed. The normalized slope (β) as well as the increase in explained variance (adj. r^2) are reported. As measures of difference T-Tests, univariate ANOVA and Mann-Whitney-U tests were conducted. When normality could not be assumed it was tested for using Shapiro-Wilk's test of normality. When normality or level of measurement were insufficient non-parametric tests were used. A level of significance was chosen at $\alpha = .05$.

3.2 Research Project: iNec

The aim of the project "iNec – Innovation through expert-communities in the time of demographic change" is to build a new personal development concept via the social interaction in "virtual communities". It is a joint research project at the RWTH Aachen University with two industry partners.

One industry partner from Germany in this research project belongs into the category of companies that have a wide range of specialized products tailored for varying type of customers. Customers vary in size, requirements, and product setup. In particular it is necessary to maintain machinery in distant areas of the world that have been developed by staff members that might go into retirement within the next decade. These circumstances make the industry partner a prototypic benefactor of the research aims given here. The other industry partner is a software company specialized in developing corporate social platforms[14] .

Since demography in Germany is a limiting factor on hiring new employees, knowledge transfer from the older generation to the considerably smaller younger generation must be optimized. Knowledge in this field is highly specialized and operation critical. In order to support this knowledge transfer the approach of the iNec-community was conceived. The purpose of the community was to channel communication through a social platform, in order to secure tacit knowledge, normally mostly forwarded through various *non-integrated* means (e.g. phone calls, video messages, issue-tracking systems, knowledge bases). These isolated solutions often lead to development of isolated knowledge. Having an integrated solution allows all actors to participate in the knowledge exchange, who might learn from this exchange or even add to it.

In order to ensure usage of the community one sub-project focussed on the user-centered design approach of the solution. The research focuses primarily on determining user requirements, motives and barriers, and motivational features of social media as a knowledge exchange environment. In interviews and focus groups important categories for later quantification were elicited, which were then operationalized. A specific focus was put on *age-related user diversity* to

[14] i.e. `http://www.intraworlds.com`

accommodate the generational gap between the learning younger generation and the "teaching" older generation of employees.

Requirement Analysis The qualitative analysis of requirements were performed by the consortial partner Textlinguistics and Technical Communication at the RWTH Aachen University. The interviews and focus groups revealed five main categories of requirements [44]. A strong need for *integration* into existing software solutions was most frequently mentioned, followed by adequate *training and support*. This means that users do not want to change existing usage behavior if it is not fully supported by the infrastructure of the company. In particular guidelines for usage were requested. Furthermore an elaborate system of *roles and rights* was needed to map visibility of data within and between business units, as well as fast *access and good usability*. The system should not cause delays and be intuitive to use. Content should also be *consistent* and integrate multi-media capabilities. Communication through the platform should be *individualized* and a *search* function is necessary [44].

To ensure that all requirements are covered by the community approach, two scenario-based questionnaire studies were conducted (N=127 and N=62). Questions were generated around fears and expectations users have regarding a community based solution for knowledge management. Four key requirements were found in the data (see Table 2). These requirements also line up with the perceived motives and barriers of the users (see Table 3).

Table 2. Key Requirements of Community based Knolwedge Management [44]

Requirement	**Description**
Ease of Use	Central requirement. Only products that are usable will be accepted independently of age.
Data-Security	Two aspects of data security are perceived by the user. First data that is entered into the system must accessible at later times. Data-loss is unacceptable for the users. Additionally users demand that their personal data can not be compromised and expect a strategic approach to ensuring data safety from their company.
Etiquette	Finding the right words to express a concern across hierarchies is complicated on its own. Finding the right words in new media is even more difficult if no established norms exist.
Customization	The solution should cater to the specific needs of the company and make the users feel at home.

When looking at user diversity, especially factors of data security [45] and etiquette [10] are important. In general requirements regard both the software solution directly as well as the implementation within the company and the applied

social norms. Both willingness to disclose personal information and etiquette requirements were analyzed in separate questionnaire surveys additionally.

Table 3. Exemplary items of social media usage barriers on a six-point Likert scale (1=total agreement to 6=total rejection) order by level of agreement descending, taken from [45]

I am skeptical about social media, because...	M	SD
... there is no established etiquette.	2.75	1.37
... it is an impersonal way of communication.	3.15	1.34
... it induces the impoverishment of interpersonal relationships.	3.15	1.45
... it facilitates voyeurism.	3.52	1.45
... social media is also involved in criminal and abuse contexts.	3.67	1.52
... it supports stalking.	4.04	1.43
etc...		

Willingness to Disclose Personal Information In another questionnaire study we assessed the willingness to disclose personal information in private and business contexts (N=151). Furthermore we looked into motives and barriers for sharing personal information in social media. Differences between the two contexts are stereotypical (see Fig. 4) as willingness to disclose business relevant information is higher in business contexts and vice versa. Especially disclosing personal private information (e.g. home address, political affiliation) is seen more critical than non personal private information (e.g. first name, last name).

In contradiction to the low willingness to disclose more sensitive information in private contexts (e.g. private cell phone number), willingness increases when used within a business context, where this information maybe useful for business conduct. Usefulness outweighs privacy needs in this case.

User diversity factors showed a particular large impact on the willingness to disclose information even in a professional setting [45]. In general the user's age has a negative effect on the willingness to disclose information. In some aspects though older users were more willing to disclose information. Disclosing the address of ones work was seen less problematic by older users than by younger users. This could have been caused by differing views on what constitutes sensitive data across generations. Gender also shows effects on the willingness to disclose certain personal information. Female users refrain to a larger extent to disclose their gender and phone numbers, which might be related to gender-related socialization (e.g. sexual harassment).

Differences in personality [46] were shown to influence social media usage in a private usage context [47–49], so investigating the influence of personality on willingness to disclose information poses a relevant question. Users that score high on the openness and extraversion scale are in general more willing to dis-

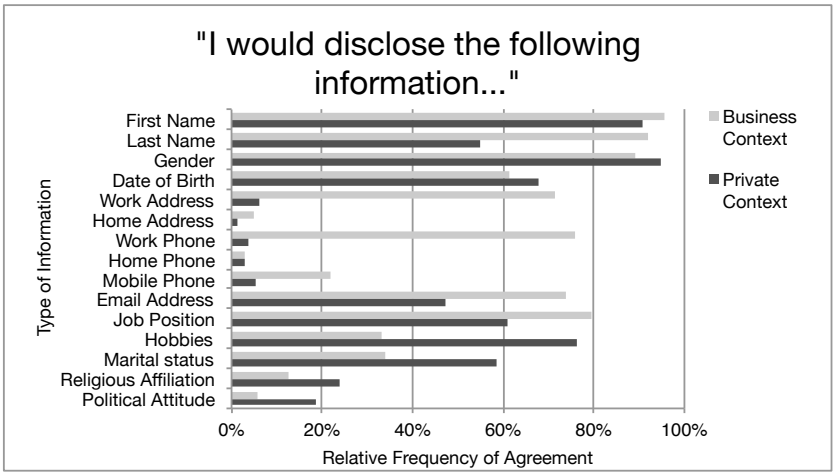

Fig. 4. Willingness to disclose personal information in both business and private context (N=151) [45]

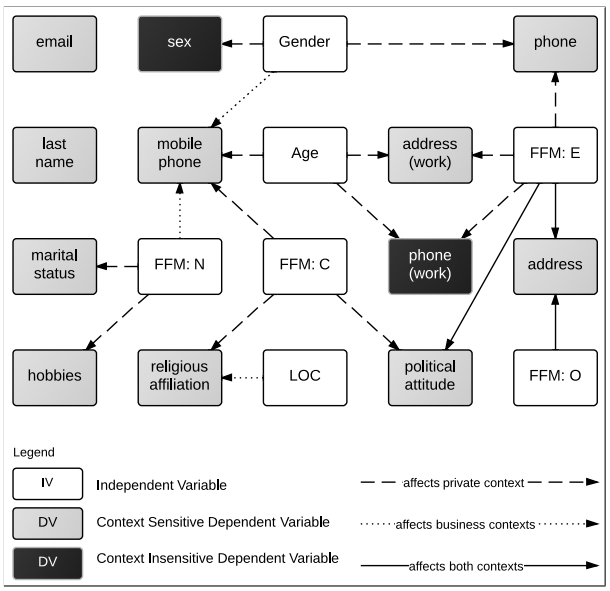

Fig. 5. Visual representation of influences of user diversity onto willingness to disclose different type of information[45]. User diversity factors presented in white. FFM=Five Factor Model, E=Extraversion, N=Neuroticism, C=Conscientiousness, O=Openness, LOC=Locus of Control.

close their information in both settings. Conscientiousness and neuroticism show negative effects on the willingness to disclose information (with the exceptions of religious affiliation and hobbies). An overview of the influenced types of information and user diversity factors that were found to play a role can be seen in Fig. 5.

Social Media Etiquette Since social media enables various forms of communication (see section 2.1) and communication underlies a plethora of rules on different levels [50], etiquette is an important factor in social media communication (see also Tab. 3). Etiquette regards the rules that are in place to enable communication of relationship and belonging. It implies a diplomatic protocol [51]. A mismatch between unestablished etiquette for new forms of media and the high regard for etiquette in business communication burden the lighthearted use of social media in knowledge exchange.

In order to determine the influence of communication type on etiquette requirements we conducted a questionnaire study with knowledge workers (N=99) to elaborate on the influence of user diversity. Three forms of social media applications were picked to represent underlying differing forms of communication. Email was chosen as an asynchronous means of communication, chat as a synchronous means of communication, and blog as a publishing medium. As measures of etiquette we operationalized six aspects of etiquette (see Table 4).

Table 4. Operationalization of etiquette and reliability of scales (Cronbach's α) [10]

Scale	α	**Description**
Formal addressing	.918	The degree to which a person demands to be addresses properly, including title, address, and capitalization.
Formal correctness	.820	The degree to which a person demands writing in a medium to be orthographically correct.
Abbreviation rejection	.831	The degree to which a person rejects the usage of abbreviations (e.g. brb for "be right back").
Emoticon rejection	.775	The degree to which a person rejects the usage of emoticons (e.g. ":-)").
Perceived Urgency	.789	The degree to which a person perceives communication in a medium as urgent.
Work disruption	.789	The degree to which a person perceives communication in a medium as disruptive to his flow of work.

We found that media differed in regard to their etiquette requirements in general. Users demand a higher degree of correctness in both addressing and orthography from email communication than from chat and blog communication. Rejection of both abbreviations and emoticons is generally low and lowest in

chat. Chat is also perceived as most urgent and most disruptive to a person's workflow (see Fig. 6).

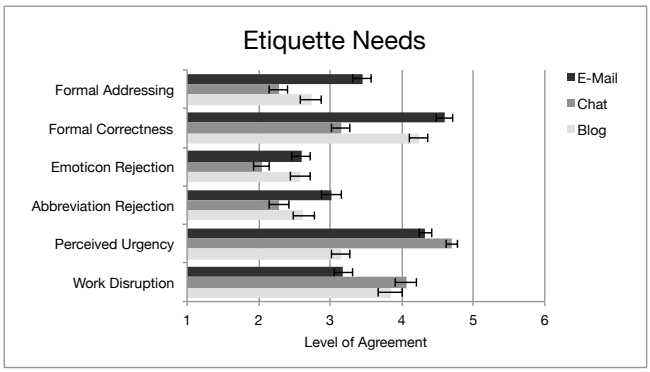

Fig. 6. Comparison of means of ettiquette requirements [10]

Looking at the influences of user diversity on these categories it became clear that the need for formal correct etiquette and the rejection of abbreviations and emoticons was strongly determined by a user's conscientiousness and age (see Fig. 7). Interestingly the desire for formal correct writing was not influenced by our measured user diversity factors, but much rather seemed to be a user characteristic on its own. The degree to which a user likes to use social media only showed a positive influence on the degree to which communication was perceived as disruptive to ones workflow (i.e. the more someone likes social media, the less he perceives it as disruptive). One must be careful to transfer these findings across cultural boundaries. Cultural influences on etiquette are immense and the findings presented reflect a German view on etiquette.

Summary Corporate Setting The results from the "iNec" research project have shown that integrating the user early in the development of a social media based knowledge exchange system is essential for the success of the solution. Users demand a usable system, which protects the data, and enables friendly interaction. Fitting the solution to the individual requirements determines a system's usefulness. Furthermore usefulness depends heavily on usability, quality of content, and user participation. User diversity factors play a similar role in regard to data disclosure and etiquette needs. Incorporating the user's needs in regard to personal information disclosure is important, because it allows users to feel safe when entering data into a social media based knowledge exchange system. Age differences in user groups can bring along requirements regarding etiquette, which need to be understood, acknowledged and regulated by the company setting up the platform. Establishing a process model for communication based on such a system is highly recommended. Beyond the need to integrate

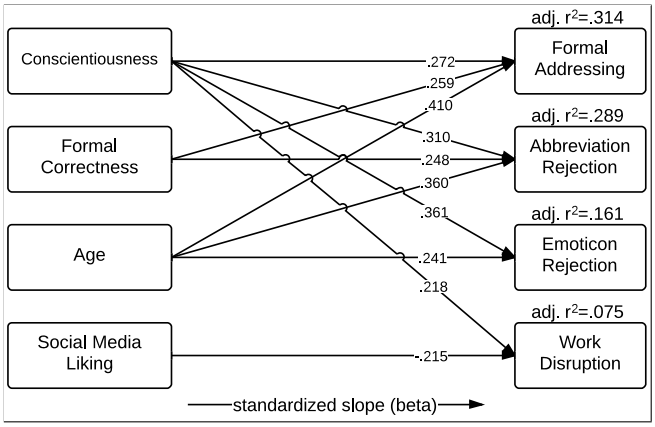

Fig. 7. Multiple linear regression analysis. Influences of user diversity factors on etiquette. [10]

the needs of current employees, one should consider the extended target group of potential employees when developing a knowledge exchange solution. Predictable development of demography forces knowledge exchange systems to be sustainable even in regard to hiring new employees, which offer another beneficial application of social media based knowledge exchange. Creating guidelines to elicit user requirements in specific situations of social media based knowledge exchange promises to aid in creation of viable solutions that can be successfully integrated into the infrastructure of companies.

3.3 Extension of Context: From an Industry to a Science Setting

The previous examples focussed on industry related social media for knowledge exchange. In a scientific setting similar needs for knowledge exchange exist. Strategic exchange of knowledge and knowledge management across disciplinary borders is necessary in both industry and science settings because of the structural similarity of the scenarios. Additionally disseminating technology from science to industry is a critical target of knowledge exchange.

The Cluster of Excellence "Integrative Production Technology in High Wage Countries" is a joint research effort at the RWTH Aachen University funded by the Excellence Initiative of the German federal and state governments [52]. The highly interdisciplinary research cluster is now in its second funding phase (of five years) and was evaluated positively for the first funding phase. In four cluster domains different topics of production research are engaged from researchers of 40 different institutes at the RWTH Aachen University. The similarity to a corporate setting and complexity of such an endeavor requires an effective knowledge management.

In order to cope with the huge demand of integrating the knowledge of the researchers across the cluster domains the so-called Cross Sectional Processes

(CSPs) were instated. The purpose of three different CSPs is to ensure sustainability of the research cluster regarding people, scientific theory, and technology [53, 54].

During the first funding phase key *requirements* of the members of the research cluster were measured and tracked in order to support the workflow of the researchers. Among others, the following key tools were identified for knowledge organization and communication in a research cluster[52]:

- Knowledge organization
  - Balanced-scorecard-based performance tracking [55]
  - Doctoral coaching
  - Gender and diversity strategy development
  - *Knowledge management systems*
  - *Expert maps*
- Communication
  - Cluster conferences
  - *Knowledge platforms*
  - Scientific colloquia
  - Student conferences
  - Diversity teams
  - Inclusion of pupils
  - Customer-researcher workshops

The tools given in *italics* can be addressed using social media based knowledge exchange, because they focus on social aspects of knowledge. Campbell [56] stated that "scientific knowledge is social". It exists in the shared knowledge of individual researchers and must be accessed socially. In order to enable both knowledge exchange and improved networking between the researchers of the cluster, the concept of the *Scientific Cooperation Portal* was devised — a social network for for knowledge exchange in scientific cooperations.

Similar social software solutions in science settings exist. Many of the tools that are used are extensions developed from the field of CSCW [57]. Zheng et al. [58] created a social software for science support called TSEP to support collaboration between scientists. Similarily Li et al [59] and Müller-Tomfelde et al. [60] highligt the need for shared workspaces and the need for audo-visual support in a health scenario setting. They also state, that the individual solution must be tailored to the requirements of the workgroup. Alves et al. [61] suggested the use of a system for finding possible collaborators that share a research interest to foster collaboration across institutional borders. Romano et al. [62] address the need for support in communication by using wikis and ontology based learning systems in the field of bioinformatics. In general tailoring the solutions to the needs of a potential user and his communicative [63] and motivational needs [64, 65] should also be regarded in a scientific setting.

The portal that we develop is a web-based service that addresses the requirements established from the first funding phase and includes the aforementioned funcionalities. The underlying software architecture is a social networking site with added collaboration tools specifically suited for interdisciplinary scientific

research. Beyond this software-based approach, additional measures like colloquia, seminars, and trainings are also offered. A strong orientation along users requirements has also been shown to be important in a scientific setting.

A Social Network for Scientific Cooperation. As features of the *Scientific Cooperation Portal* different applications are provided. One application addresses the problems of differing scientific terminologies, offering an interdisciplinary view on shared terminology between cluster domains, without losing the rigor of disciplinary definitions. Creating a concept of differing understandings of terminology is a key aim of the terminologies application [66].

In order to simplify project planning and communication of research plans the application "FlowChart" is created. The main focus of this application is to visualize the dependency of work-packages and results of a research process, as well as tracking of progress. This enables both researchers as well as industry partners to communicate more effectively about their research projects [67].

Another feature deals with the specificity of a platform within a production technology setting. Technology transfer and in particular knowledge about available technology within a cluster can be assisted through a *technology platform*. One goal is to create transparency of the technologies developed within the interdisciplinary research cluster as well as the technology experts behind them. In a first step, the technology transfer portal will be part of the Scientific Cooperation Portal and will only be accessible to members of the cluster. Later on, public access will be granted to dedicated information in order to open up the cluster technologies to external interest groups such as potential industrial partners or external research institutions. To ensure usage of the portal findings from related research projects carry over to the development of the Scientific Cooperation Portal. The benefit of this platforms is, that without too much additional effort communication of technology to external stakeholders or business partners can be integrated into the workflow from within the cluster (see section 2.4 for further information). Thus technology platforms connect the process of internal and external technology communication.

Improvement of networking of members is addressed, by providing yellow pages of all cluster members. The yellow pages contain information about the hiring institute, contact data and research focus. A visual representation of collaboration is achieved by a tool that employs *Publication Relationship Analysis*, which focuses on the scientific output of the cluster.

Sharing Non-Personal Sensitive Data in Social Networks? One feature of the *Scientific Cooperation Portal* presented here in detail is the *Publication Relationship Analysis* application. Scientific publications are one important output of scientific work that provide information on collaboration, external reception, and scientific content. Publications contain the actual research results. They can therefore be used to indirectly measure the social network of participating researchers, the growth of knowledge, but are also often used as a key performance indicator.

If integrated into a social portal the presentation of publication data in regard to knowledge exchange could allow showing core competencies of research groups by analyzing keywords, terminology, and additional user given input. Extracting referenced literature and mapping the "reference base" of research groups could allow new members of the cluster to identify key publications to read. This could help compensate for the fast staff turn-over in scientific settings. Additionally it allows finding key knowledge agents that have a better overview over cluster-relevant scientific output in form of publications, patents, and technology profiles. Making this knowledge available for external stakeholders is considered highly beneficial for the research cluster, as it provides a core means of disseminating innovations into industry.

In an interview study [68] with interdisciplinary active researchers (N=5) we investigated properties of this approach. In particular we looked at applicability of information presentation for analyzing interdisciplinarity and the chances of a visualization being a support in the research process settings. As key benefits of this approach *positive impact on work performance*, advantages in the *planning* process, and the possibility of *retrospective analysis* were identified.

This very positive feedback was nonetheless contrasted with key barriers. Participants mentioned in particular that forms of visualizations could be *missing information* besides publications that are also indicative of interdisciplinary cooperation. Additionally a visualization does not give feedback about the *quality* of the publications, and might have a negative influence on the workflow (i.e. increase of social pressure).

The interview study led to the conclusion that different types of data presentation are needed to be employed and to tackle the different goals of the platform. In order to enable *self-measurement of success factors* for the individual scientists an ego-centric view of the data (i.e. showing only the user's own publications [69, 70]) should be provided. This allows individualized feedback and enables the user to understand his own publishing behavior. By adding additional meta-data from a full-fledged social portal (like a Scientific Cooperation Portal) some of the missing data could be added to this view. This allows to give the researcher a profile-based view on all his research activities. Furthermore this egocentric view prevents negative impacts like social pressure, because individuals cannot compare their results directly. Adequate evaluation (in particular comparison) of two researchers in an interdisciplinary setting requires a certain amount of training to apply corrective factors according to the researchers diversity factors (e.g. length of scientific career, discipline, career goals, etc.).

Summarizing we can say that even publicly available information (i.e. publication data) can become a sensitive topic, when presented in a centralized manner. Employees as well as researchers are both aware of possible risks of disclosing personal or work related information. Not knowing who might look into ones profile can bring along a feeling of uncertainty, which hinders the willingness to disclose information in the first place. Therefore it is essential to engage potential users early in the development process and regard possible barriers early on.

In this context it is interesting to see whether the need to hide or disclose performance data may vary with personal factors (e.g. personality, age), or with contextual factors viewable within the platform (e.g. discipline, etc.), or rather social factors (e.g. relationships of friends, close collaborators, persons in a close spatial work environment). Furthermore, it could be studied how the willingness to disclose personal information might change over time, as barriers might change due to usage.

4 Conclusion

The spectrum of social media for knowledge exchange encompasses both industry and scientific applications. Both settings are highly knowledge dependent and struggle with staff-turnover and the resulting need to improve knowledge exchange and secure knowledge sustainably. In one case this is triggered by demographic change in the other by short-lived academic contracting.

The specificities of these scenarios bring along specialized needs that need be tackled by individualized solutions. The spectrum of social media for knowledge exchange applications can range from talent onboarding (see section 2.3), over scientific social knowledge exchange (see section 3.3), over generational knowledge exchange (see section 3.2), to technology transfer applications (see section 2.4).

The differences in user diversity in these scenarios play a important role in establishing suitable requirements for a social media knowledge exchange system. The benefits of these systems can only be reaped when users actually integrate the system into their daily workflow. Integration can only be reached when the users see benefits in using the system for their work. Usefulness and ease of use have traditionally been shown to influence acceptance of ICT but provide only a limited view on systems that depend immensely on user participation. In addition to the basal necessity of usefulness and ease of use, quality of content and social interaction are both necessary and sufficient and thus central conditions for success.

A systematically user-centered approach when designing a social media based knowledge exchange system is highly recommended in order to synchronize the goals of the system with the goals of the future users. Our results have shown that respecting user diversity in regard to willingness to disclose personal information lower the entry barriers for using such a system, while explicitly defining social norms for communication improves the perception of daily use by establishing a consistent and matching etiquette. Most critically, the success will depend on the fragile acceptance of social media etiquette. Even though it is a factual need, companies should not just urge the members to use it. Employees will use it if they have the chance to individually tailor the way of using the system. This includes different needs of privacy, a different sensitivity to social pressure and the human wish to control systems [71, 72].

A tailored concept of features aligning with the specificity of the usage scenario paves the way for triggering motivation to communicate, participate, and

collaborate in a social media based knowledge exchange system. Connecting all considerations about user requirements promises to offer an improved fit of user and technology, which enables a system to become a "social" network. These networks can contain two different kinds of connections – strong and weak ties. While the strong ties of a social network are important for daily work, weak ties are a source of innovation. The strong ties of a social network can benefit from social media applications that enhance the necessary daily knowledge exchange by adding further means of communication to the repertoire of employees. Even work-based strong ties can be achieved and fostered when employees are globally distributed across various time zones or are take part in location-independent flexible work models (e.g. home-office, parental leaves, sabbatical). Leveraging the strength of the weak ties in ones social network by making them readily available is crucial for any innovation processes. social media based knowledge exchange activates this network by making the connections visible, accessible and navigable. Weak ties can exist intra-organizational in larger companies but also across borders of organizations with potential employees or business partners. In a connected globalized world it is essential to ensure integration of new generations of employees and the complete network of possible customers/partners early on. Weaving both strong and weak ties into a tighter social network via social media can attain sustainability of knowledge for both industry and academia. Integrating the findings from both worlds has lead to a deeper understanding of how to improve modern approaches of knowledge exchange and management through social media. It is essential for both industry and academia to allow knowledge to permeate through organizational borders (in a controlled manner) to retain sustainability in a globally connected world.

Acknowledgments. We would like to thank the anonymous reviewers for their constructive comments on an earlier version of this manuscript. The authors would like to thank all partners from the research projects for their constructive collaboration and feedback. The studies from the "iNec" project have been funded by the German Ministry of Education and Research (BMBF) and the European Social Fund (ESF) within the program "Innovationsfähigkeit im demographischen Wandel" under the reference number 01HH11045. The work related to the project "Integrative Production Technology in High Wage Countries" has been funded by the Excellence Initiative of the German federal and state governments.

References

1. Bloom, D.E., Canning, D.: Global demographic change: Dimensions and economic significance. Working Paper 10817, National Bureau of Economic Research (October 2004)
2. Sturgeon, T.J.: Does manufacturing still matter? The organizational delinking of production from innovation. (1997)
3. Howells, J.R.: Tacit knowledge, innovation and economic geography. Urban studies **39**(5-6) (2002) 871–884

4. Granovetter, M.S.: The strength of weak ties. American journal of sociology (1973) 1360–1380
5. Rogers, E.M., Adhikarya, R.: Diffusion of innovations: An up-to-date review and commentary. Communication yearbook **3** (1979) 67–81
6. Holzinger, A.: Human-computer interaction and knowledge discovery (hci-kdd): What is the benefit of bringing those two fields to work together? In: Availability, Reliability, and Security in Information Systems and HCI. Springer (2013) 319–328
7. Alagöz, F., Calero Valdez, A., Wilkowska, W., Ziefle, M., Dorner, S., Holzinger, A.: From cloud computing to mobile internet, from user focus to culture and hedonism: the crucible of mobile health care and wellness applications. In: Pervasive Computing and Applications (ICPCA), 2010 5th International Conference on, IEEE (2010) 38–45
8. Ardichvili, A., Page, V., Wentling, T.: Motivation and barriers to participation in virtual knowledge-sharing communities of practice. Journal of knowledge management **7**(1) (2003) 64–77
9. Bughin, J., Manyika, J., et al.: How businesses are using web 2.0: A McKinsey global survey. McKinsey Quarterly Web Exclusive. McKinsey and Company (2007)
10. Calero Valdez, A., Schaar, A.K., Ziefle, M.: Personality influences on etiquette requirements for social media in the work context. In: Human Factors in Computing and Informatics. Springer (2013) 427–446
11. Majchrzak, A., Wagner, C., Yates, D.: Corporate wiki users: results of a survey. In: Proceedings of the 2006 international symposium on Wikis. WikiSym '06, New York, NY, USA, ACM (2006) 99–104
12. Hemsley, J., Mason, R.M.: The nature of knowledge in the social media age: Implications for knowledge management models. In: System Science (HICSS), 2012 45th Hawaii International Conference on, IEEE (2012) 3928–3937
13. Facebook: Facebook reports first quarter 2013 results. Accessed September 12th 2013: `http://investor.fb.com/releasedetail.cfm?ReleaseID=761090` (2013)
14. Java, A., Song, X., Finin, T., Tseng, B.: Why we twitter: understanding microblogging usage and communities. In: Proceedings of the 9th WebKDD and 1st SNA-KDD 2007 workshop on Web mining and social network analysis, ACM (2007) 56–65
15. Sigurbjörnsson, B., Van Zwol, R.: Flickr tag recommendation based on collective knowledge. In: Proceedings of the 17th international conference on World Wide Web, ACM (2008) 327–336
16. Drucker, P.F.: Knowledge-worker productivity: The biggest challenge. The knowledge management yearbook 2000-2001 (1999)
17. Maier, R.: Knowledge management systems: Information and communication technologies for knowledge management. Springer (2007)
18. Davenport, T.H., Pruzak, L.: Working knowledge: How organizations manage what they know. Harvard Business Press (2000)
19. Paroutis, S., Al Saleh, A.: Determinants of knowledge sharing using web 2.0 technologies. Journal of Knowledge Management **13**(4) (2009) 52–63
20. Richter, A., Stocker, A., Müller, S., Avram, G.: Knowledge management goals revisited–a cross-sectional analysis of social software adoption in corporate environments. In: Proceedings of the 22nd Australasian Conference on Information Systems. (2011)
21. Maier, R., Remus, U.: Towards a framework for knowledge management strategies: process orientation as strategic starting point. In: System Sciences, 2001. Proceedings of the 34th Annual Hawaii International Conference on, IEEE (2001) 10–pp

22. Prusak, L.: Where did knowledge management come from? IBM systems journal **40**(4) (2001) 1002–1007
23. Kaiser, S., Müller-Seitz, G., Lopes, M.P., e Cunha, M.P.: Weblog-technology as a trigger to elicit passion for knowledge. Organization **14**(3) (2007) 391–412
24. Giglia, E.: Academic social networks: its time to change the way we do research. European journal of physical and rehabilitation medicine **47**(2) (2011) 345–349
25. Bauer, T.N., Erdogan, B.: Organizational socialization: The effective onboarding of new employees. (2011)
26. Aberdeen Group: Onboarding 2013 – A New Look at New Hires. `http://aberdeen.com/Aberdeen-Library/8383/RA-strategic-onboarding-talent.aspx` (2013)
27. Willyerd, K.: Social tools can improve employee onboarding. `http://blogs.hbr.org/cs/2012/12/social_tools_can_improve_e.html` (December 2012)
28. Schuh, G., Aghassi, S.: Technology Transfer Portals: A Design Model for Supporting Technology Transfer via Social Software Solutions. In: Proceedings of the IEEE International Conference on Industrial Engineering and Engineering Management (IEEM). (2013)
29. Schuh, G., Wemhöner, H., Drescher, T.: Technologiemanagement als lebensfähiges System gestalten. In Mieke, C., Braunisch, D., eds.: Innovative Produktionswirtschaft. Logos Verlag, Berlin (2012) 59–77
30. Schuh, G., Klappert, S., eds.: Technologiemanagement. Produktion und Management. Springer, Heidlberg (2012)
31. Schuh, G., Aghassi, S., Calero Valdez, A.: Supporting Technology Transfer via Web-based Platforms. In: Technology Management in the IT-Driven Services, Proceedings of the PICMET' 2013 Conference. (2013)
32. Czarnitzki, D., Licht, G., Rammer, C., Spielkamp, A.: Rolle und Bedeutung von Intermediären in Wissens-und Technologietransfer. ifo Schnelldienst **54**(04) (2001) 40–49
33. Leupold, M.: Technologietransfer im Web 2.0 – wie das Wissen heute in die Welt kommen kann. Wissensmanagement 1 (2010) 21ff.
34. Fishbein, M., Ajzen, I., Hinkle, R.: Predicting and understanding voting in american elections: Effects of external variables. Understanding attitudes and predicting social behavior (1980) 173195
35. Davis, F.D.: Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly **13**(3) (1989) 319–340 ArticleType: research-article / Full publication date: Sep., 1989 / Copyright (c) 1989 Management Information Systems Research Center, University of Minnesota.
36. Bagozzi, R.P., Davis, F.D., Warshaw, P.R.: Development and test of a theory of technological learning and usage. Human Relations **45**(7) (July 1992) 659–686
37. Lee, Y., Kozar, K.A., Larsen, K.R.: The technology acceptance model: Past, present, and future. Communications of the Association for Information Systems **12** (2003) 780
38. Pedersen, P.: An adoption framework for mobile commerce. Towards the E-Society (2002) 643–655
39. Lu, J., Yu, C.S., Liu, C., Yao, J.E.: Technology acceptance model for wireless internet. Internet Research **13**(3) (2003) 206–222
40. Yang, H., Yoo, Y.: It's all about attitude: revisiting the technology acceptance model. Decision Support Systems **38**(1) (2004) 19–31
41. Venkatesh, V., Morris, M.G., Davis, G.B., Davis, F.D.: User acceptance of information technology: Toward a unified view. MIS Quarterly **27**(3) (2003) 425–478

ArticleType: research-article / Full publication date: Sep., 2003 / Copyright (c) 2003 Management Information Systems Research Center, University of Minnesota.
42. Hartwick, J., Barki, H.: Explaining the role of user participation in information system use. Management science **40**(4) (1994) 440–465
43. Preece, J., Nonnecke, B., Andrews, D.: The top five reasons for lurking: improving community experiences for everyone. Comp. in Hum. Beh. **20**(2) (2004) 201–223
44. Schmitz-Urban, A., Bender, J., Gudergan, G., Schaar, A.K., Calero Valdez, A., Löcker, A.K., Eraßme, D., Hofmann, J., Ziefle, M., Jakobs, E.M.: Einsatz von Experten-Communitys zur Sicherung der Innovationsfähigkeit im demografischen Wandel. In Jeschke, S., ed.: Innovationsfähigkeit im demografischen Wandel. Campus Verlag, Frankfurt/New York 87–104
45. Schaar, A.K., Calero Valdez, A., Ziefle, M.: The impact of user diversity on the willingness to disclose personal information in social network services. In: Human Factors in Computing and Informatics. Springer (2013) 174–193
46. Costa, P.T., McCrae, R.R.: Normal personality assessment in clinical practice: The neo personality inventory. Psychological assessment **4**(1) (1992) 5
47. Amichai-Hamburger, Y., Vinitzky, G.: Social network use and personality. Comput. Hum. Behav. **26**(6) (November 2010) 1289–1295
48. Correa, T., Hinsley, A.W., de Ziga, H.G.: Who interacts on the web?: The intersection of users' personality and social media use. Comput. Hum. Behav. **26**(2) (2010) 247–253
49. Hughes, D.J., Rowe, M., Batey, M., Lee, A.: A tale of two sites: Twitter vs. facebook and the personality predictors of social media usage. Comput. Hum. Behav. **28**(2) (2012) 561–569
50. Rothwell, J.D.: In the company of others: An introduction to communication. McGraw-Hill Humanities/Social Sciences/Languages (1999)
51. Brown, P., Levinson, S.C.: Politeness: Some universals in language usage. Volume 4. Cambridge University Press (1987)
52. Brecher, C., Jeschke, S., Schuh, G., Aghassi, S., Arnoscht, J., Bauhoff, F., Fuchs, S., Jooß, C., Karmann, W.O., Kozielski, S., et al.: Integrative production technology for high-wage countries. Springer (2012)
53. Welter, F., Jooß, C., Richert, A., Jeschke, S., Brecher, C.: Organisation and management of integrative research. In: Automation, Communication and Cybernetics in Science and Engineering 2011/2012. Springer (2013) 275–285
54. Jooß, C., Welter, F., Richert, A., Jeschke, S., Brecher, C.: A management approach for interdisciplinary research networks in a knowledge-based society – Case study of the cluster of excellence "Integrative Production Technology for High-wage Countries". In: Automation, Communication and Cybernetics in Science and Engineering 2011/2012. Springer (2013) 375–382
55. Welter, F., Vossen, R., Richert, A., Isenhardt, I.: Network management for clusters of excellence-a balanced-scorecard approach as a performance measurement tool. In: Automation, Communication and Cybernetics in Science and Engineering 2009/2010. Springer (2011) 195–207
56. Campbell, D.T.: Ethnocentrism of disciplines and the fish-scale model of omniscience. In Derry, S.J., Schunn, C.D., Gernsbacher, M.A., eds.: Interdisciplinary collaboration: An emerging cognitive science. Psychology Press (2001) 3–21
57. Jirotka, M., Lee, C.P., Olson, G.M.: Supporting scientific collaboration: Methods, tools and concepts. Computer Supported Cooperative Work (CSCW) **22**(4-6) (2013) 667–715
58. Zheng, X., Ke, G., Zeng, D.D., Ram, S., Lu, H.: Next-generation team-science platform for scientific collaboration. Intelligent Systems, IEEE **26**(6) (2011) 72–76

59. Li, J., Muller-Tomfelde, C., Robertson, T.: Designing for distributed scientific collaboration: a case study in an animal health laboratory. In: System Science (HICSS), 2012 45th Hawaii International Conference on, IEEE (2012) 373–381
60. Müller-Tomfelde, C., Li, J., Hyatt, A.: An integrated communication and collaboration platform for distributed scientific workgroups. In: Human-Computer Interaction–INTERACT 2011. Springer (2011) 248–258
61. Alves, T.P., Borges, M.R., Vivacqua, A.S.: An environment to support the discovery of potential partners in a research group. In: Computer Supported Cooperative Work in Design (CSCWD), 2013 IEEE 17th International Conference on, IEEE (2013) 344–349
62. Romano, P., Giugno, R., Pulvirenti, A.: Tools and collaborative environments for bioinformatics research. Briefings in bioinformatics **12**(6) (2011) 549–561
63. Calero Valdez, A., Schaar, A.K., Ziefle, M.: State of the (net) work address developing criteria for applying social networking to the work environment. Work: A Journal of Prevention, Assessment and Rehabilitation **41** (2012) 3459–3467
64. Schaar, A.K., Calero Valdez, A., Ziefle, M., Eraßme, D., Löcker, A.K., Jakobs, E.M.: Reasons for using social networks professionally. In: Social Computing and Social Media. Springer International Publishing (2014) 385–396
65. Calero Valdez, A., Schaar, A.K., Ziefle, M., Holzinger, A.: Enhancing interdisciplinary cooperation by social platforms. In: Human Interface and the Management of Information. Information and Knowledge Design and Evaluation. Springer International Publishing (2014) 298–309
66. Vaegs, T., Welter, F., Jooß, C., Leisten, I., Richert, A., Jeschke, S.: Cluster terminologies for promoting interdisciplinary scientific cooperation in clusters of excellence. INTED2013 Proceedings (2013) 5805–5812
67. Jooß, C., Welter, F., Leisten, I., Richert, A., Schaar, A., Calero Valdez, A., Nick, E., Prahl, U., Jansen, U., Schulz, W., Ziefle, M., Jeschke, S.: Scientific cooperation engineering in the cluster of excellence integrative production technology for high-wage countries at RWTH Aachen University. In: ICERI2012 Proceedings. 5th International Conference of Education, Research and Innovations, IATED (19-21 November, 2012 2012) 3842–3846
68. Schaar, A.K., Calero Valdez, A., Ziefle, M.: Publication network visualisation as an approach for interdisciplinary innovation management. In: Professional Communication Conference (IPCC), 2013 IEEE International. (2013)
69. Calero Valdez, A., Schaar, A.K., Ziefle, M., Holzinger, A., Jeschke, S., Brecher, C.: Using mixed node publication network graphs for analyzing success in interdisciplinary teams. In: Active Media Technology. Springer (2012) 606–617
70. Calero Valdez, A., Schaar, A.K., Ziefle, M.: Measuring interdisciplinary performance by analyzing mixed node publication networks. In Hinze, S., Lottmann, A., eds.: Proceedings of the 18th International Conference on Science and Technology Indicators: Translational twists and turns: Science as a socio-economic endeavor. IFQ, Berlin (2013) 594–597
71. Wilkowska, W., Ziefle, M.: Privacy and data security in E-health: Requirements from the users perspective. Health Informatics Journal **18**(3) (2012) 191–201
72. Arning, K., Gaul, S., Ziefle, M.: "Same same but different" How service contexts of mobile technologies shape usage motives and barriers. In: HCI in Work and Learning, Life and Leisure. Springer (2010) 34–54