Social Knowledge Environments

Social software has changed research and practice in the knowledge management field. Several current trends and research issues offer a new understanding of how social software has changed this research field, as well as how scholars in business and information systems engineering (BISE) should take up this emerging research field. The article offers a review of such trends and a framework for addressing the remaining issues.

DOI 10.1007/s12599-014-0318-4

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Received: 2013-03-10
Accepted: 2013-12-05
Accepted after three revisions by Professors Bichler, Hess, Krishnan, and Loos.
Published online: 2014-02-20

This article is also available in German in print and via http://www.wirtschaftsinformatik.de: Pawlowski JM, Bick M, Peinl R, Thalmann S, Maier R, Hetmank L, Kruse P, Martensen M, Pirkkalainen H (2014) Soziale Wissensumgebungen. WIRTSCHAFTSINFORMATIK. doi: 10.1007/s11576-014-0409-3.

Electronic Supplementary Material
The online version of this article (doi: 10.1007/s12599-014-0318-4) contains supplementary material, which is available to authorized users.

1 Introduction

Social software has changed research and practice in the knowledge management (KM) field (von Krogh 2012). Several current trends and research issues offer a new understanding of how social software has changed this research field, as well as how scholars in business and information systems engineering (BISE) should take up this emerging research field. The present article offers a review of such trends and a framework for addressing the remaining issues.

For the past several decades, information systems (IS) scholars and practitioners alike have been studying KM (Heisig 2009; Holsapple and Joshi 2002; Lee and Chen 2012; Serenko et al. 2010). Many KM system functionalities (Alavi and Leidner 2001) have offered the promise of improving how organizations handle knowledge (Maier 2007). However, the actual results rarely achieve the exaggerated outcomes promised by the vast hype over KM (Heisig 2009; Serenko et al. 2010). More recently, social software (Hippner and Wilde 2005; Richter et al. 2011) has prompted renewed expectations for the ways in which technology might help organizations improve their KM – backed up by global success stories that feature hundreds of millions of users (e.g., Facebook). Since the productivity of knowledge workers also remains a critical challenge for organizations (Drucker 1994), social software has had a notable influence on KM research and practice (Avram 2006; Hemsley and Mason 2013; Zheng et al. 2010).

Research into social software has adopted social, organizational, and technical perspectives, such as studies of the adoption of technology across different generations (Kaplan and Haenlein 2010), management of social applications (Brambilla et al. 2012), collaboration in distributed teams (Oshri et al. 2008), or the security and reliability of enabling technologies (Kärkkäinen et al. 2010). From a methodological standpoint, this research is diverse, featuring qualitative, quantitative, analytical, and constructive methods (Wallace et al. 2011). Furthermore, market trends have increased the availability of various collaboration infrastructures to employees, such as MS SharePoint, Lotus Notes, Jive, or Liferay. Global, distributed organizations thus have new tools to manage their knowledge-intensive processes. However, social software also raises new questions: How does it alter the KM practices in organizations? How can organizations design and manage their environment by adopting the new breed of software to ensure they function in social knowledge environment that comprises concepts, methods, and tools that benefit KM purposes? (see definition in Sect. 3.1).

No extant research has addressed the extent to which the IS discipline can contribute to a clearer understanding of the

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Appendix

We limited the *search population* to journal papers and peer-reviewed conference proceedings, as they provide the necessary rigor and quality in scientific research. With respect to *search resources*, we included all databases that were accessible through the library subscriptions of the institutions with which the authors have been affiliated: ACM Digital Library, Ebscohost (Academic Search Complete and Business Source Complete), Emerald, IEEE Xplore Digital Library, Sage Journals, ScienceDirect, SpringerLink, Web of Knowledge, and Wiley. We searched all resources between 2000 and 2012; the review took place in 2012. The exception is the legal perspective, which we conducted in response to a reviewer's request in 2013, so it included papers published in 2013. The search terms were applied to title and abstract, not the full text, which helped reduce blurring and limited the results to a reasonable number. The restriction to empirical research reduced the number of results from 450 to about 60 in IEEE. Table A1 shows the *search terms* representing each of the dimensions raised in Section 1 and detailed as key areas of research, as described next.

Tab. A1 Review dimensions and search terms

Dimension (key area of research)	**Search term**
Social and cultural dimension (Social software for knowledge management)	("enterprise social" OR "knowledge management" OR "knowledge sharing") AND ("social software" OR "social media" OR "web 2.0" OR bookmarking OR "social networking" OR blogging OR "micro-blogging" OR wiki OR "collaborative writing") AND (survey OR case study)
Organizational and contextual dimension (Support of for distributed organizations in knowledge-intensive settings)	(team*OR group*) AND (distribut* OR virtual* OR dispers*) AND ((ICT OR IT) OR (information* OR knowledge*))
Technical (Standards and interoperability)	("knowledge management" OR "knowledge sharing") AND (interoperability OR standard)
Legal dimension (Data protection and legal aspects)	("social media" OR "social software") AND ("data protection" OR legal OR law)

Tab. A2 Barriers, interventions, and gaps for social software and knowledge management

Topic/Barriers	Interventions and Solutions/ Limitations	Methods	Research Strand
Communication in teams (Kärkkäinen et al. 2010; Noll et al. 2010; Zhao and Chen, 2013)	Current: Communication technology is the most commonly cited approach to overcome the geographic distance problem. Use of social network analysis to identify communication intensity. Gaps: The provision of tools and services does not guarantee success. Relation to various other challenges and therefore, persistent challenge to address. Process and tools to activate team members, in particular non-active users.	Qualitative empirical study (interviews, content analysis), case study, action research, social network analysis	Social software, cross-border KM
Productivity depends on social communication tools, especially in large, geographically dispersed organizations (Onyechi and Abeysinghe 2009; Ramasubbu et al. 2005)	Current: Social communication improves productivity only if processes are sufficiently mature. Single sign-on for different social media tools increases adoption and user satisfaction. Gaps: Lack of differentiation among different social communication tools and their functionality.	Conceptual study and empirical validation	Semi-permeable organization, social software, cross-border KM
Organizational support in terms of training, common practices, and policies (Husin and Hanisch 2011; Pallot et al. 2010)	Current: Trying to reach an understanding of which mechanisms foster collaboration and support the adoption of emerging technologies and services, such as creating an organizational policy for social software. Gaps: Identification of good practices and instruments; successful adoption and large-scale awareness not reached.	Constructive research, qualitative empirical study (interview, theoretical mapping)	Crowd knowledge, semi-permeable organization
Integration of social software in other information systems (Millen et al. 2006)	Current: Social software, such as wikis, social networks, or bookmarking is not integrated with enterprise search or corporate directory. Gaps: Many other integration scenarios, such as integration with collaboration tools and office software, must be considered as well.	Case study, constructive research with field trial	Social software

Coupling of intranet and Internet social services (Müller and Stocker 2011)	Current: Intranet services are strictly separated from the Internet, resulting in the need for double posting or double monitoring for employees. Gaps: Identification of mechanisms that easily allow employees to decide which information may be published on the Internet, according to privacy policies.	Case study, qualitative empirical study	Social software
Reasons for sharing or not sharing knowledge using social software (Paroutis and Al Saleh 2009)	Current: Information overload and lack of time increased, instead of reduced, by social software. Gaps: How new and advanced tools can replace existing tools.	Case study, qualitative empirical study	Social software
Lack of authoritative content in social software (Dagenais and Robillard 2010)	Current: Readers do not know whether the content is correct and authorized from the respective authority. Gaps: Balance between hurdle of contributing and authoritativeness discussed, but no feasible solution presented so far.	Qualitative empirical study (exploratory field study)	Social software
Ambivalent role of awareness mechanisms (Treude and Storey 2010)	Current: Awareness mechanisms may be used to create social pressure, which is a major barrier to their adoption. Gaps: Balance between strict data privacy laws and benefits of extensive data collection and analysis by software tools.	Qualitative and quantitative empirical study	Social software
Tag reuse and structure (Storey et al. 2009)	Current: Users demand a way to create hierarchical tags. To further reuse, a suggestion system may be used. Gaps: Semantic web technologies to be used to allow for more complex relations than hierarchies, though still are not easy to use for non-IT professionals.	Multiple case study, qualitative validation	Social software
Active blog users benefit most from the system (Jackson et al. 2007)	Current: Blog users benefit from getting specialist knowledge and social connections. Gaps: Amount of time spent blogging not taken into account.	Quantitative and qualitative empirical study (survey)	Social software
Social bookmarking helps expert finding, community building, information sharing, and discovery (Damianos et al. 2007; DiMicco et al. 2008; Pan and Millen 2008)	Current: Analysis mainly based on system logs. Perceived benefits by users may differ from judgment of the analyst. Gaps: Bookmarking for teams or groups not covered, though some teams want a team account.	Quantitative and qualitative empirical study (survey)	Social software

Microblogging enhances awareness of other users' activities and social communication (Barnes et al. 2010)	Current: Short messages do not need a character limit to work. Gaps: Privacy protection is needed for some communication.	Quantitative and qualitative empirical study (survey)	Social software
Microblogging shows current topics of discussion better than a KM system (Hoong et al. 2012)	Current: Text mining can extract communication patterns from microblogging. Gaps: Comparative studies of different social media tools are missing.	Quantitative and qualitative empirical study	Social software
Urgent requests for help are better answered when social media activities are used to find the right experts (Wiener et al. 2012)	Current: Targeted automatic request performs better than an untargeted one. Gaps: Compare automatic targeting with manual selection based on experts' finder application.	Quantitative empirical study (survey)	Social software
Social media needs to support business processes (Graupner et al. 2012)	Current: Social media tools are not used as much as expected in the case examined, due to missing business process support. Gaps: No empirical evidence that extensions of social media to support business processes really increase usage and value.	Quantitative empirical study (survey)	Semi-permeable organization
Social media users need feedback (Brzozowski 2009; Brzozowski et al. 2009)	Current: Feedback and managers' own activity determine activity level of employees in social networks. Perceived IT support is a barrier. Social media tools provide no automatic feedback regarding reception of own postings. Gaps: Automatic feedback mechanisms need to be tested.	Quantitative and qualitative empirical study (survey)	Social software
Structured data can be shared via social networks (Geyer et al. 2008)	Current: Small lists with five items are shared in the survey. Gaps: Larger lists, as in SharePoint, could be socially shared too.	Quantitative and qualitative empirical study (survey)	Social software
Language barriers are an issue for global cooperation (Yu et al. 2011)	Current: Automatic filtering based on social and geographic criteria and translation can help. Gaps: Cultural differences must be considered, as well as language.	Qualitative empirical study (survey)	Cross-border KM

Tab. A3 Barriers, interventions and gaps for globally distributed teams

Topic/Barriers	Interventions and Solutions/ Limitations	Methods	Research Strand
Trust and awareness (Dubé and Robey 2009; Kanawattanachai and Yoo 2007; Riege 2005; Thomas and Bostrom 2010a)	Current: Mistrust can be instrumental to build trust, but there is still a lack of knowledge about how virtual teams establish trust and trust another's expertise. Trust and awareness building require different instruments. Gaps: Understand which effect IT has on establishing trust and how functionality needs to be designed to support it; new instruments needed for building trust.	Qualitative empirical study (interview, content analysis), laboratory experiment (survey), grounded theory	Crowd knowledge, Cross-border KM
Conflict (Thomas and Bostrom 2010a; Wakefield et al. 2008)	Current: Leadership roles and collaboration technology can lower task, process, and relationship conflict. Gaps: Explore what IT functionality impacts which kind of conflict type.	Qualitative empirical study (interview, survey)	Crowd knowledge, Cross-border KM
IT support (Dubé and Robey 2009; Majchrzak et al. 2005; Thomas and Bostrom 2010a)	Current: Distributed teams need to rely on IT functionality that supports their tasks by providing adequate contextual information. They also need the knowledge of how to use provided IT functionality to best fit their tasks. Gaps: Support the complex decision-making process of what IT functionality could be appropriate to fit a team's tasks and how to use it.	Qualitative empirical study (interview, content analysis, survey), grounded theory	Social software
Team members (Dubé and Robey 2009; Kanawattanachai and Yoo 2007; Oshri et al. 2008; Robert et al. 2008; Staples and Webster 2008)	Current: Team members need to be selected carefully by considering expertise or past working history. Over time, team members establish norms, rules, or procedures to coordinate their team activities. Use of social network analysis to identify communication intensity. Gaps: Understand the potential effects when teams members come together and identify with differing IT services. Activating team members, in particular non-active users.	Qualitative empirical study (interview, content analysis, case-study, laboratory experiment (survey)	Semi-permeable organization, crowd knowledge

Team leaders (Staples and Webster 2008; Thomas and Bostrom 2010b; Wakefield et al. 2008)	Current: Leaders in distributed teams have various roles (e.g., facilitator, coordinator, mentor) and need to rely on team members' willingness and knowledge to use technology for teamwork. Gaps: Support team leaders in assessing the current state of the team's technology knowledge to arrange for appropriate facilitation interventions when necessary.	Qualitative empirical study (survey, interview)	Semi-permeable organization
Coordination processes (Dubé and Robey 2009; Kanawattanachai and Yoo 2007; Thomas and Bostrom 2010b)	Current: The coordination of team members in distributed settings is challenging without knowledge of which strategies teams apply to coordinate their work. Gaps: Develop process and outcome indicators to determine when team members should meet to coordinate their next steps.	Qualitative empirical study (interview, content analysis, laboratory experiment, survey), grounded theory	Crowd knowledge, cross-border KM
Knowledge transfer (Choi et al. 2010; Oshri et al. 2008; Robert et al. 2008; Thomas and Bostrom 2010b)	Current: In distributed settings, the transfer of knowledge is cumbersome even though IT has advanced considerably. However, other than sharing knowledge, team members need to apply knowledge to the problem at hand. Gaps: Explore the effects of single IT functionality on knowledge sharing and application.	Qualitative empirical study (case study, interviews), laboratory experiment (survey)	Crowd knowledge, Cross-border KM, social software
Cultural diversity (Hung 2008; Pallot et al. 2010)	Current: Cultural and diversity studies integrated to KM domain by enriching previous culture models and knowledge on the subject. Gaps: Development of KM-specific culture models	Qualitative empirical study (case study, ethnographic approach, field experiment, observation)	

Tab. A4 Barriers, interventions, and gaps for the technology perspective

Topic/Barriers	Interventions and Solutions/ Limitations	Methods	Research Strand
Reliability and security of information exchange (Kärkkäinen et al. 2010)	Current: Focus primarily on technology improvements, not on research. Gaps: Mental mind-sets on social software are often the main barrier, not security threats. Further research into issues of trust and intention to share knowledge is required.	Qualitative empirical study (literature study, expert interview, survey)	Social software, crowd knowledge
Privacy concerns and handling of sensitive information (Campisi et al. 2009; Grace 2009)	Current: Formalization of guidelines and best practices, relying on a set of principles, such as collecting data with the knowledge and consent of the individual, specifying the purpose of the data, and protecting the data against misuse. Gaps: Understanding of the purpose of the social software tool is often lacking. Privacy concerns often needless.	Qualitative empirical study (literature study, interview)	Social software, crowd knowledge
Interoperability between diverse information systems (Jung 2012; van Wamelen and de Kool 2008)	Current: A lack of technical standards makes knowledge sharing and semantic interoperability difficult. Gaps: Overall strategy for the tools is often missing from the integration process.	Qualitative empirical study (literature analysis, field experiment)	Social software
Interoperability of different vocabularies (Lei Zheng and Mai Chan 2004)	Current: Direct mapping, leaf-node linking, and other methods applied in some cases. Gaps: Adopt the idea of the linked open data project within enterprises.	Qualitative empirical study (literature study)	Social software
Knowledge integration and re-use (Happel et al. 2008; Kamsu Foguem et al. 2008)	Current: Exchange of experiences or feedback through lessons learned or artifact documentation. Gaps: Introduction of standard vocabulary for case descriptions.	Qualitative empirical study (literature study), conceptual study (prototype development)	Semi-permeable organization
Contextual enrichment (Gupta and Seshasai 2007; Nunes et al. 2009)	Current: Ontology-based representation of contextual information and recording. Gaps: Analyze cost considerations with introduction and maintenance of ontology-based environments.	Conceptual study (prototype development), case study	Cross-border KM, crowd knowledge

Tab. A5 Barriers, interventions and gaps for the legal perspective

Topic/Barriers	Interventions and Solutions/ Limitations	Methods	Research Strand
Challenges for knowledge protection in social media (Väyrynen et al. 2013)	Current: Organizations lack knowledge protection and security-oriented KM processes related to social media. Gaps: Creation of KM and protection strategies for KM; finding a balance between knowledge sharing and knowledge protection strategies.	Qualitative empirical study, (interviews) case study	Social software
Knowledge protection in innovation management (Olander et al. 2011)	Current: Organizations lack a systematic knowledge-protection strategy. Gaps: Additional research on efficient knowledge-protection mechanisms in diverse organizations, cultures, and legal environments to preserve core knowledge and prevent competitors from imitating are required.	Qualitative empirical study (literature study), case study	Semi-permeable organization
Organizational risk management and IT security management (Manhart and Thalmann 2013)	Current: Organizational risk management relies on data protection. Gaps: Risk management should also focus on knowledge protection. Integration of IS security management, performance management, and KM.	Qualitative empirical study (literature study; research in progress)	Cross-border KM
Legal aspects hinder research in social intranets (Dolog et al. 2009)	Current: Mainly data from social communities in the open Web are analyzed. Gaps: Analyzing data from enterprise social software.	Literature and expert interviews	Social software
Trust in enterprise microblogging networks (Chelmis and Prasanna 2013)	Current: Research uses trust as an indicator for expertise in enterprises. Gaps: Research of trust that implies not exploiting newly acquired knowledge for malicious deeds.	Quantitative empirical analysis	Social software
Social networks derived from enterprise e-mail data (Lin et al. 2012)	Current: In certain circumstances, intranet data can be collected legally. Gaps: Develop a commonly accepted method for collecting data in enterprises without violating laws.	Quantitative empirical analysis	Cross-border KM

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development of social knowledge environments. In the face of this gap, we propose a consideration of four categories of challenges (Pirkkalainen and Pawlowski 2013):

1. *Social and cultural dimensions*, such as challenges related to individual and group behavior, in particular culturally specific behaviors (e.g., Ågerfalk et al. 2005; Leidner et al. 2006; Pallot et al. 2010). We focus on the implications of enterprise social software for differences across cultures and borders as the use of social software and knowledge exchange differs strongly depending on cultural aspects (Pirkkalainen and Pawlowski 2013).
2. *Organizational and contextual dimensions*, including challenges tied to a particular context, organization, organizational unit, project, process management, or task (e.g., Avram 2006; Brambilla et al. 2012; DiMicco et al. 2008; Levy 2009; Zheng et al. 2010).
3. *Technical dimensions*, related to the adoption of technologies and their use in organizations (e.g., Onyechi and Abeysinghe 2009).
4. *Knowledge protection and legal dimensions*, such as the potential loss of knowledge, privacy, and filtering of offensive or illegal contents (e.g Alstete 2003; Väyrynen et al. 2013).

On the basis of this categorization, we analyze several key questions related to potential research areas, which we derive from a structured literature review of BISE/IS-related research. What barriers and challenges do knowledge workers face when collaborating globally through social software? What gaps persist in the IS discipline's knowledge base with respect to these barriers and challenges? What solutions have been proposed? Our initial answers to these questions lead to a proposed research agenda with four strands. We also note the contributions and methodological considerations that the BISE/IS community needs to address.

2 Procedure

We conducted a structured literature review (SLR) to determine the barriers, limitations, and current trends related to social knowledge environments. Following the principles of SLR (Webster and Watson 2002), our repeatable, well-structured procedure sought to identify, evaluate, and interpret relevant literature for our research aim. Through our search strategy, we defined the search population, resources, and terms, as well as inclusion and exclusion criteria (online Appendix Table A1; all appendices available online via http://link.springer.com). The SLR consisted of two steps. First, we reviewed the abstracts, introductions, and conclusions of all articles found through an initial search to identify relevant studies. This approach is appropriate for information technology and software engineering literature, because the abstracts of articles in these fields tend to be insufficient, so we cannot rely solely on them (Brereton et al. 2007). Second, we analyzed the articles we identified as relevant in the first step, according to the barriers they address, the interventions and solutions they provide, and the scientific methods they apply. Thus, we classified mainstream (highly discussed), emerging, and immature topic areas (cf. Lee and Chen 2012). This categorization resulted from a collaborative research process among the coauthors: After agreeing on an initial categorization, we separated into four research teams, each of which determined categorizations of the topics, barriers, solutions, and interventions for different subsets of the corpus. In addition, we discussed our assignments during synchronous video conferences and mapped the identified barriers and research gaps. After three categorization cycles, both within teams and during plenary sessions, we identified current research strands as the result of the process, which then led to our research agenda.

3 Social Knowledge Environments: Analysis Results

In this section, we consider knowledge barriers and research gaps from social (Sect. 3.1), organizational (Sect. 3.2), technical (Sect. 3.3), and legal (Sect. 3.4) perspectives, for each research area identified in our analysis. These discussions combine to derive our research agenda, including a discussion of methods (Sect. 3.5). Detailed results are available in the Appendix.

3.1 Social Software for Knowledge Management

Social software represents the new hope of KM (Jackson 2010; von Krogh 2012). It comprises systems that are based on Internet technology; that support the monitoring of peripheral activity and that enable many-to-many communications (Cook 2008). Various terms serve to refer to this new, quickly growing phenomenon, including social media (Kaplan and Haenlein 2010) and user-generated content (Cha et al. 2007). Regardless of the name, its development is evident in the increasing popularity and usage statistics surrounding social networks, blogs, wikis, and media-sharing platforms, which in turn result in vast amounts of noisy, distributed, unstructured, and dynamic data (Gundecha and Liu 2012). Furthermore, challenges emerge regarding strategic as well as process management solutions in these settings (Brambilla et al. 2012; von Krogh 2012). In addition, some consensus indicates that social software is not only a technological but also an ideological phenomenon, that is, "a group of Internet-based applications that build on the ideological and technological foundations of Web 2.0, and that allow the creation and exchange of User Generated Content" (Kaplan and Haenlein 2010, p. 61). In adaptive structuration terms, it entails not just technological affordances (Markus and Silver 2008) but also attitudes toward the technology (DeSanctis and Poole 1994) and the spirit of using this new breed of software. Building on the definitions of enterprise knowledge infrastructure (Maier et al. 2009) and KM system (Alavi and Leidner 2001), we propose that a social knowledge environment is defined as a comprehensive arrangement of information and communication technology (ICT) applications that are contextualized and integrated. Based on a shared ontology, they at least foster awareness of others' activities, encourage contributions of user-generated content, and support networking for knowledge processes that seek to increase the performance of knowledge work. Social software also has shifted our understanding of KM to include informal, bottom-up, interest-driven practices performed by engaged individuals who are well connected in distributed, diverse, dynamic social constellations.

We identified 17 key barriers in our SLR, ranging from societal challenges and organizational issues to barriers for specific social software applications. Social software should run publicly on the Internet; it becomes more useful due to network effects (O'Reilly 2005). However, usage practices also depend on national and organizational cultures (Leidner et al. 2006). Moreover, adoption and

interoperability processes are critical as software dominates particular contexts. As organizations seek to avoid publicly sharing their core knowledge (Müller and Stocker 2011), knowledge protection limits the use of social media in organizations (Väyrynen et al. 2013). Therefore, we concentrated our research on enterprise social software (Richter et al. 2011) that runs within company firewalls.

Technical gaps also include extraction of information from social knowledge environments, transformation of social data into searchable documents, their transmission to partners without permanent Internet access, and freezing of information that has been distributed across several systems for further refinement. These gaps can hinder knowledge maturation (Barnes et al. 2009). To trace the complex process of collaboratively creating knowledge in social knowledge environments, various initiatives have arisen, such as activity streams (Peinl et al. 2013). We provide a detailed list of these challenges and barriers in Table A2 in the online Appendix.

3.2 Support for Distributed Organizations in Knowledge-Intensive Settings

As more organizations rely on distributed settings for their work, KM serves an increasingly crucial role, particularly in domains that require frequent knowledge exchanges, such as global software development (Noll et al. 2010). The coordination of team activities and interactions in teams are well-known pitfalls (Thomas and Bostrom 2010) that result in decreased satisfaction and performance (Schweitzer and Duxbury 2010). We thus identified eight key barriers and related interventions: characteristics of team members and team leaders, provision of IT support, coordination, knowledge transfer, trust, conflict, and cultural diversity.

Distributed teams depend on the availability of IT, but they often can rely only on a specific set of provided functionalities, some of which do not fit their tasks. It is important to specify the knowledge context, especially if it is transferred through IT (Majchrzak et al. 2005). However, we lack knowledge about which strategies team members apply to coordinate their knowledge (Kanawattanachai and Yoo 2007), even though we find that team members often fail to integrate shared knowledge (Choi et al. 2010). Several studies emphasize the need to select team members carefully to create open, decentralized communication patterns but also establish procedures, standards, and templates for codifying information (Oshri et al. 2008), which can hamper the formation of subgroups (Staples and Webster 2008). We also lack a good understanding of how to design processes and collaboration technology that can adapt easily to team norms and patterns, or how to maintain dynamic relations across the people who participate in multiple teams with social knowledge environments. In addition, team leaders need assistance to improve knowledge transfer (Staples and Webster 2008) and assess a team's technology knowledge (Thomas and Bostrom 2010) if they are to arrange appropriate facilitation interventions. The challenges and barriers in this field appear in Table A3 in the online Appendix.

3.3 Standards and Interoperability

Standards are key for IT/IS (Krcmar 2005) because they help organizations in varied activities, such as migrating from an old to a new system (Haller 2009), interchanging data with business partners (Jung 2011), accessing systems from different devices and client software (Yu et al. 2008), or integrating systems to harness their data relations (Lei Zeng and Mai Chan 2004). The market of enterprise social software seems dominated by closed source solutions offered by large vendors (Drakos et al. 2012), with a lack of interoperability. We identified six main barriers in our SLR that reflect a technology perspective, ranging from general integration issues to specific challenges, such as knowledge contextualization.

Few standards are available for enterprise integration in general (Panetto and Molina 2008) and social software or the exchange of social data in particular (Peinl et al. 2013). Current data exchange strategies rely on the prerequisite that every participant has online access to the same social software installation. Without this access, the necessary information must be collected from internal systems, transformed into a document, and provided to the partner; alternatively, employees could use different platforms, depending on the team members with whom they want to share information with. However, interoperability generates additional complexity (Kamsu Foguem et al. 2008). Consequently, formal, ontology-based experience feedback is required to cope with that challenge. Special attention should be paid to capturing the experience, as well as its context, because a shared view of context is crucial for knowledge sharing (Nunes et al. 2009). If it is possible to derive at least some part of the context automatically, such as in a software development environment, semantic recommendations can support users (Happel et al. 2008). However, no standard exists for exchanging these semantic context descriptions; therefore, every team member has to use the same tool to benefit from such recommendations. This approach also might be used in various settings. For example, with composite persona (Gupta and Seshasai 2007), extensive recordings of users' activities in so-called knowledge events help people on different continents or time zones take over the work. This method raises privacy concerns though (Campisi et al. 2009), and the exchange of context information across organizational boundaries requires secure communication channels to prevent eavesdropping (Kärkkäinen et al. 2010). A detailed list of these challenges and barriers appears in Table A4 in the online Appendix.

3.4 Knowledge Protection and Legal Aspects

The challenge of finding a balance between knowledge sharing and knowledge protection has been exacerbated by recent developments. Knowledge protection refers to a firm's efforts to maintain knowledge in its original and constructive state (Väyrynen et al. 2013). Even within an enterprise context, knowledge sharing occurs when devices can be used at home, in the workplace, during transportation periods, and in the course of leisure activities, such that they blur the borders between work and leisure, as well as between knowledge sharing for the individual or for the job (Väyrynen et al. 2013). To overcome these challenges, organizations need a holistic risk management approach that accounts for both data and the knowledge perspective (Manhart and Thalmann 2013; Bayer and Maier 2006). However, many organizations lack a clear or systematic knowledge protection strategy (Olander et al. 2011). Furthermore, social knowledge environments pose a challenge in terms of compliance with legal regulations, such as

the Sarbanes-Oxley Act, Basel Accords, and so forth, in conjunction with privacy protection and equality laws (Otter 2007).

3.5 Methods

Social knowledge environments represent a relatively new research area, mainly investigated using exploratory, qualitative research methods. An overview how social software in organizations is currently investigated can be found in (Sect. 3.1 – online Appendix Table A2) Studies of social software beyond organizational boundaries mainly rely on (large) data sets, collected from social media. In distributed organizations (Sect. 3.2 – online Appendix Table A3), exploratory qualitative approaches are combined with grounded theory approaches, based on interviews and in-depth data collection methods. In contrast, standardization studies (Sect. 3.3 – online Appendix Table A4) mainly refer to prior literature, with a few prototypical implementations. We find very few attempts applying design science research. Large-scale quantitative empirical research that seeks to test the theories or confirm results gathered from explorative research appear in the domain of distributed organizations, yet studies that operationalize team processes or team states during collaboration are scarce.

4 Toward a Research Agenda for Social Knowledge Environments

We have identified topics in social knowledge environments that we deemed helpful for both the BISE/IS academic community and professionals (Sect. 2; Appendix). Starting from these topics, we identified gaps across four topic areas (Sect. 3). Next, we clustered the barriers and possible solutions into four main research strands (vom Brocke et al. 2011), which we synthesized to cover most of the findings. Accordingly, we propose a research agenda that addresses main barriers, solution approaches, and methodological recommendations. Although necessarily incomplete, it provides a starting point for further development and discourse in the BISE/IS community.

4.1 The Semi-Permeable Organization

This concept refers to organizations that engage in practices spanning or crossing organizational boundaries, such as cooperating, crowdsourcing, applying flexible employment schemes, or participating in cross-organizational projects. It also encompasses IT practices such as consuming cloud services or allowing bring-your-own-device strategies. From an organizational perspective, softening these boundaries has both virtues and risks. Several findings have already indicated that social software can improve knowledge work, on local and global levels (Levy 2009; Zheng et al. 2010). Using social software helps blur organizational boundaries and diffuse knowledge more quickly. From a social perspective, openness and inter-organizational collaboration demand new mental mindsets and organizational change. So far KM mainly concentrated on the facilitation of sharing, while risks resulting from social knowledge environments and protective measures are widely neglected so far (Väyrynen et al. 2013). Furthermore, it is also recommended that organizations recreate organizational boundaries to rebuild the employees' awareness for risks of unwanted knowledge sharing (von Krogh 2012).

First, future research should focus on the investigation of risks related to sharing knowledge in social knowledge environments (von Krogh 2012). The next step from an empirical perspective would be to investigate the risks of engaging in social knowledge environments in more detail following the proposals from (Väyrynen et al. 2013) and (Jarvenpaa and Majchrzak 2010) for example. Finding a balance between strict privacy regulations and the need to harness insights by applying social network analysis to an extensive collection of social data in and beyond organizational boundaries also requires research from a legal perspective. From a design science perspective the next step should be to develop technical measures that help address such risks. One promising approach could be to adapt procedures from the domain of information security in this regard (Manhart and Thalmann 2013).

Second, future research should focus on the development of standards, such as those for context transfer, to facilitate interoperability between systems in relation to shared knowledge objects. Specifically, a standard for exchanging context information is needed; see Peinl et al. (2013) for a first ontology-based approach. Analytics of social knowledge environments need to be developed and hence feasible approaches for content and context extraction of knowledge objects from (social software) systems need to be investigated as means to transfer and re-embed content and context into systems of partner organizations. Analysis of available logs of social software platforms seems promising in this regard (van der Aalst 2012).

Finally, we propose that research should investigate the organizational uptake and deployment of social software, to foster a globally networked organization (online Appendix). Here, especially more empirical research on both the intended and the unintended effects of using social software in organizations is needed. Targeting questions of trust and organizational changes needs input from psychology and social sciences for investigating this interdisciplinary research direction.

4.2 Social Software in Professional Work Settings

A key issue relates to the usage, adoption, and impact of social software applications in work settings. The concept of professional work settings draws attention to the connections of social software to (1) individual work settings, i.e. personal workspaces of employees engaged in knowledge work (Kelloway and Barling 2000; Pyöriä 2005), to (2) collaborative work settings, i.e. the workspaces of communities of practice and other social constellations such as work groups, project teams or informal professional networks that support both formal organizational processes and informal organizational practices (Orlikowski 2000) and to (3) organizational work settings, i.e. enterprise systems that primarily support formal organizational processes and practices (Crossan et al. 1999; Nonaka et al. 2006). Analyses of social perspectives often rely on Facebook and Twitter data, hence, on public social software, rather than social software used in professional work settings as it is often much more difficult to obtain data from corporate intranets,. Thus, engaging in work practice studies (Blackler et al. 1993; Orlikowski 2000) reflecting professional activities in workplaces, rather than public social environments, is a key challenge.

Future research pertaining to the organizational dimension should investigate effects of new IT features for improved knowledge acquisition, development and sharing processes, hence, performance of employees in professional

work settings (Davenport et al. 2002). Social software also raises concerns about how it affects an individual's, a group's or an organization's focus of attention versus distraction from their professional tasks and therefore its effects on task performance (Bailey and Konstant 2006; Kohlegger et al. 2013).

From a technical perspective, we suggest to improve semantic interoperability among social, collaboration and office software, as well as productivity tools for knowledge work and other business applications. We propose the Linked Open Data initiative as a model, which might be transferred to corporate information systems. Passant et al. (2009) detail its advantages for intranet tagging systems. Further research should apply it to other areas such as product mentioning in different documents or systems with varied keywords. Such research also should include interdisciplinary approaches – whether computer science to inform interoperability issues or social sciences to clarify the social changes resulting from the use of new technologies.

4.3 Crowd Knowledge

Crowd knowledge refers to processes, activities, and resources that are created and deployed by a large, often organization-independent user base (Yang et al. 2008). This focus area therefore pertains to barriers related to handling knowledge, due to social changes. From the social perspective, the nature of teams in social media-enabled settings has changed considerably since small group research in the 1980s and 1990s.

As a consequence, efforts in future research should lead to an improved understanding of which theories apply to individual, team, or organizational levels in relation to social media support. Some attempts at employing theory-based research in the domain of open innovation and crowdsourcing include, for example, motivation theory (Leimeister et al. 2009) and system theory (Geiger et al. 2011). We also require research that improves our identification of trustworthy mechanisms to enable employees to decide which information should be published within their team, organization, or beyond, instead of emphasizing personalized IT services to foster information exchange and performance (Dondio and Longo 2011). An additional recommendation includes continuing research in the technical dimension on the development of IT integration strategies that acknowledge the challenges of knowledge-diverse collaboration settings.

Moreover, from an organizational perspective, the increasing penetration of social media poses a challenge to whether current KM practices allow for appropriate knowledge creation, transfer, and exploitation. If the potential benefits that social media can offer for transferring knowledge within the organization were clear (Lee and Chen 2012; Zheng et al. 2010), research could improve KM in terms of greater trust and thus a willingness to share knowledge throughout the collective, with lower information overload, greater quality and accuracy of knowledge obtained from the crowd, and support for team leaders in assessing the team's knowledge, such that it would facilitate collaboration. According to this, a related legal question involves how to trace authorship and preserve copyrights in such settings (Wolfson and Lease 2011). The BISE/IS discipline can contribute to innovative, cross-disciplinary, research-based solutions. Finally, the IS discipline should emphasize rigorous, design-science research that seeks to develop intelligent task routing and team formation mechanisms (Cosley et al. 2007) as well as social recommendation systems (Guy et al. 2010).

4.4 Cultural Differences and Cross-border KM

In distributed settings (across geographical or organizational boundaries), KM raises new challenges related to cultural and contextual differences (Leidner et al. 2006; Noll et al. 2010). This item relates to cultural and contextual barriers. From a social perspective, cultural aspects and KM across borders are key to understanding social knowledge environments in global settings. In general, we note three main types of cultural research, focused on national, organizational, and team classifications. The need to create, share, and use knowledge across organizational and cultural borders assigns massive potential to this topic in BISE/IS settings. Even as researchers become more involved in international networks, few results stem from comparative or multi-context studies.

On an organizational level, we see a clear need for comparative studies in cross-border and cross-organizational settings that refer to the adoption and diffusion of social KM. For example, research rarely considers the different adoption and acceptance processes that occur between Asia and Europe. As our SLR showed, interdisciplinary research, combined with various methods, is required to understand this phenomenon clearly. From both perspectives – organizational and individual – we see a need to further analyze, improve and validate culture models for KM: a systematic analysis of cultural influence factors needs to be done in interdisciplinary research groups. Furthermore, from an organizational perspective, we need to understand how organizations should organize their cross-border KM, localization, and general adaptation. Technically, social software solutions should be interoperable across systems, languages, and cultures. These challenges call for design-oriented research that provides recommendations for collaboration and performance improvement. Although this issue was raised 14 years ago (Katzy et al. 2012), results remain scarce.

4.5 Methods for Studying Social Knowledge Environments

Validating design-based innovations in social knowledge environments represents a promising yet challenging research activity. In particular, it is necessary to create validation scenarios across organizational and geographical borders on a more general level than the current isolated, anecdotal evidence available. We must progress from laboratory experiments with student samples to samples of professionals, participating in (near-)field experiments in organizations, and then to longitudinal studies. If researchers can access real-world data sets in actual environments, opportunities abound for increasing the rigor of empirical studies, beyond a dominant method of opinion polls. The result should be a better understanding of the effects of social knowledge environments in organizations, useful for further improvements. Qualitative and quantitative analysis techniques also must be applied to clarify the impact of process and technology changes.

Again, different disciplines should contribute to developing the comprehensive design, adoption, and diffusion of social knowledge environments. The BISE/IS community could promote and facilitate interdisciplinary discourses to es-

Table 1 Recommended Methods for Topic Areas

Method	Topic area			
	Semi-permeable organization	Social software in professional work settings	Crowd knowledge	Cultural differences and cross-border KM
Qualitative empirical	Knowledge risks arising from social knowledge environments	Social software-supported collaborative practices performed in professional work settings	Trust mechanisms and intention to share	Cultural influence factors; barriers for specific country contexts
Quantitative empirical	Effects on knowledge sharing and the absorptive capacity in professional organizational networks	Effects of social software on (informal and formal) processes and performance of employees on the individual, group and organizational level	Effects of crowd processes on knowledge creation and sharing in intra- and inter-organizational settings	Comparative studies focusing on adoption and diffusion of KM solutions; theories towards cultural influences on global social KM
Design science	Adoption of concepts, models and tools from information security and introduction of new standards	Concepts, models and tools improving semantic interoperability between organizational social software applications	Concepts, models and tools improving intelligent task routing and team formation	Recommender systems; new tools (e.g., social collaboration environments) for global settings

tablish the research domain. Intercultural communication research might address social knowledge environments in global contexts (Shuter 2012). The role of social software in societies (e.g., adoption, diffusion issues) might be discussed from a sociological point of view (Han 2010). Educational sciences offer insights into competences and their development (Tess 2013), interlinking activities in social knowledge environments with individual, team, and organizational performance, particularly as they relate to technology-enhanced learning and a strong design orientation (Chan et al. 2006). Customer integration by social software also has been intensely studied in marketing and innovation management fields (Fliess et al. 2011; Kohler et al. 2011). Because innovation in KM is largely driven by technology, computer science topics – particularly interactive design, research in mobile devices, context- and location-aware computing, grid and cloud computing, as well as security and privacy – seem highly relevant. This connection should include methods explored by BISE/IS researchers, such as controlled experiments or ethnography, that are routinely applied in social sciences and psychology. We regard these examples as a starting point for potential interdisciplinary research and discourse. **Table 1** summarizes the recommended methods for the discussed topic areas.

5 Conclusion

The consumerization of IT and global social media, involving millions of owners of devices and users who spend vast amounts of their (paid and unpaid) time participating in social media, create opportunities for revisiting KM in organizations. In particular, we perceive a chance to deliver on the promise that IS and IT can contribute to improving the productivity and quality of knowledge work, as well as performance of teams and organizations. Yet the existing academic and professional knowledge base is insufficient for designing and deploying social knowledge environments, within and across the boundaries of organizations, compared with the knowledge base available about global, public social media.

Although the past decade has experienced strong trends toward the integration of human- and technology-centered research streams, as well as new technology approaches (e.g., semantic web, ontology concepts for KM; Lee and Chen 2012), we have sought to summarize the current state of the emerging research area related to social knowledge environments from different perspectives. We identified four research strands and a methodological arrangement that appear promising for ongoing research conducted by the BISE/IS community. How do we proceed from here? We encourage researchers to (1) address the four research areas with combinations of theory-led design science research, employing controlled experiments and field studies that go beyond opinion polls and rely on data collected in actual social knowledge environments; (2) pursue interdisciplinary research and engage in projects that combine researchers' complementary competencies, to master the methodological issues that arise from the study of complex social phenomena in real-world organizations; (3) create innovation through design-oriented solutions, including designs of business models, processes, software tools, and services; (4) systematically analyze global challenges and differences using comparative or multi-context studies to investigate different adoption and acceptance patterns across countries and continents; and (5) support diffusion and adoption through standardization, to sustainably transfer research results to a broad range of professionals and organizations.

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Abstract

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Social Knowledge Environments

Knowledge management represents a key issue for both information systems' academics and practitioners, including those who have become disillusioned by actual results that fail to deliver on exaggerated promises and idealistic visions. Social software, a tremendous global success story, has prompted similarly high expectations regarding the ways in which organizations can improve their knowledge handling. But can these expectations be met, whether in academic research or the real world? This article seeks to identify current research trends and gaps, with a focus on social knowledge environments. The proposed research agenda features four focal challenges: semi-permeable organizations, social software in professional work settings, crowd knowledge, and cross-border knowledge management. Three solutions emerge as likely methods to address these challenges: design-oriented solutions, analytical solutions, and interdisciplinary dialogue.

Keywords: Distributed team, Global team, Information system, Knowledge management, Organization, Social networking, Social software, Tools

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