



**University of  
Zurich**<sup>UZH</sup>

**Zurich Open Repository and  
Archive**

University of Zurich  
University Library  
Strickhofstrasse 39  
CH-8057 Zurich  
[www.zora.uzh.ch](http://www.zora.uzh.ch)

---

Year: 2015

---

## Idea Hubs as Nexus of Collective Creativity in Digital Innovation

Ciriello, Raffaele Fabio ; Richter, Alexander

**Abstract:** Digital innovation radically transforms the nature of corporate innovation practices, implying a growing need for deeper understanding its origins and outcomes. In this paper, we conceptualize the focal points of social networking in digital innovation as idea hubs. We focus our analysis on instances of idea hubs in two multinational European software companies, where we conducted a case study over a two-year period, and collected data in form of interviews, digital documents, and participant observations. In doing so, we identify a set of social networking practices in which idea hubs serve as nexus of collective creativity and subject these to a critical dialectical examination. We discuss three influencing factors of idea hub choice, namely material infrastructure, innovation process phase, and personal characteristics. These explain why in a corporate environment, despite a variety of digital artifacts individuals can choose from, offline interaction still plays a major role in facilitating digital innovation.

Posted at the Zurich Open Repository and Archive, University of Zurich

ZORA URL: <https://doi.org/10.5167/uzh-120056>

Conference or Workshop Item

Published Version

Originally published at:

Ciriello, Raffaele Fabio; Richter, Alexander (2015). Idea Hubs as Nexus of Collective Creativity in Digital Innovation. In: 36th International Conference on Information Systems (ICIS 2015), Fort Worth, USA, 13 December 2015 - 16 December 2015, ICIS.

# **Idea Hubs as Nexus of Collective Creativity in Digital Innovation**

*Completed Research Paper*

**Raffaele Fabio Ciriello**  
University of Zurich  
Department of Informatics  
Binzmühlestrasse 14  
8050 Zürich, Switzerland  
ciriello@ifi.uzh.ch

**Alexander Richter**  
University of Zurich  
Department of Informatics  
Binzmühlestrasse 14  
8050 Zürich, Switzerland  
arichter@ifi.uzh.ch

## **Abstract**

*Digital innovation radically transforms the nature of corporate innovation practices, implying a growing need for deeper understanding its origins and outcomes. In this paper, we conceptualize the focal points of social networking in digital innovation as idea hubs. We focus our analysis on instances of idea hubs in two multinational European software companies, where we conducted a case study over a two-year period, and collected data in form of interviews, digital documents, and participant observations. In doing so, we identify a set of social networking practices in which idea hubs serve as nexus of collective creativity and subject these to a critical dialectical examination. We discuss three influencing factors of idea hub choice, namely material infrastructure, innovation process phase, and personal characteristics. These explain why in a corporate environment, despite a variety of digital artifacts individuals can choose from, offline interaction still plays a major role in facilitating digital innovation.*

**Keywords:** Idea Hub, Collective Creativity, Digital Innovation, IS Development, Social Networking

## **Motivation and Research Goal**

Digital innovation currently attracts growing attention in information systems (IS) research. Having major and, at times, unforeseen impacts on individuals, organizations, and economies, a deep understanding of the origins and outcomes of digital innovation is crucial for academic research and industrial practice. In today's corporate environment, innovation processes have become more open and collaborative in nature, with IT as decisive enabler of networked innovation involving distributed stakeholders (Chesbrough, 2003; Sawhney and Nambisan, 2007). Despite the recently growing number of studies (see Yoo et al., 2012 for an overview), the IS discipline is still far away from having a consistent body of theory to explain important phenomena related to digital innovation, as recent calls and special issues in leading IS journals reflect (Fichman et al., 2014; Nambisan et al., 2014; Yoo et al., 2012, 2010). Particularly the practice of developing digital innovation and the role of digital technologies and human behavior therein remain important topics for IS research (Nambisan, 2003; Nambisan et al., 2014).

However, although the importance of understanding digital innovation in a business context continues to rise (Yoo et al., 2010), few studies have taken a systematic approach towards understanding how firms actually practice digital innovation. As a result, there is still an important gap in our understanding of managing digital innovation in organizations. We know yet little about the problem class of enabling digital innovation practices in a corporate environment and how to create facilitating conditions therefor.

The goal of this paper is to understand the role of social networking in digital innovation practices. Our analysis is grounded on extensive fieldwork we conducted onsite in two multinational European software enterprises. Over a period of two years, one author was able to study practices related to the development of innovative software products and obtained a deep practical understanding of the problem at hand. From this relationship, the need to address digital innovation practices from a social networking perspective emerged in order to better understand the constantly changing way companies innovate with and toward digital technologies. We zoomed in on the focal points of social networking at the case companies through a qualitative examination of semi-structured interviews we conducted with 95 experienced innovators, 480 digital documents we collected from online platforms, and in total 181 days of participant observations. In doing so, we offer rich insights into digital innovation practices at these companies. By building on a model of collective creativity (proposed by Hargadon and Bechky, 2006), we are able explain how the nexus of creative problem solving lies within interactions between individuals who choose between a variety of online and offline spaces to exchange ideas. We term these focal points of social networking in digital innovation practices 'idea hubs' and, more specifically, address the guiding research questions: *What role do idea hubs play in digital innovation practices?* And: *What factors influence individuals' choice of idea hubs?*

Our contribution is threefold. Firstly, this paper contributes to the emerging literature on digital innovation by deepening our understanding of digital innovation practices. For this purpose, we analyze and conceptualize two software companies' focal points of social networking as idea hubs and focus our analysis on concrete instances of idea hubs as nexus of collective creativity. In doing so, we identify a set of idea hubs. Secondly, weaving the innovation practices in which the idea hubs are embedded enables us to dialectically examine the appropriateness of idea hubs in different contexts. This dialectical appraisal has practical implications in that it illustrates the selection decisions made by different stakeholders who engage in collective creativity. It also has theoretical implications in that it provides a state of the art analysis of social networking in digital innovation. Thirdly, we distinguish three influencing factors on which the choice of idea hubs therein depends, namely 1) the material infrastructure that surrounds the idea hub, 2) the innovation process phase in which employees use the idea hub, and 3) personal characteristics of the individuals that are connected through the idea hub. We discuss that these three influencing factors help to explain why in a corporate environment, despite a variety of digital artifacts innovators can choose from, offline interaction still plays a major role in facilitating digital innovation.

The remainder of this paper is structured as follows. We start by expounding the theoretical foundations of digital innovation and collective creativity. We also conceptualize the term idea hub as a theoretical perspective for studying collective creativity in digital innovation. The research approach section then offers detailed insights into our method and illustrates how we analyzed networking practices in our empirical study. In the results section, we describe in detail how employees use different kinds of idea hubs as nexus of collective creativity in various ways. We then continue with a discussion of the novel insights and implications our results offer for understanding the nature of digital innovation and for the application of a social networking-based perspective for the analysis of innovation practices. We conclude with summarizing the key takeaways of the study and suggesting areas for future research.

## **Related Work**

### ***Digital Innovation***

Fichman et al. (2014, p. 330) broadly define *digital innovation* as a “product, process, or business model that is perceived as new, requires some significant changes on the part of adopters, and is embodied in or enabled by IT”. Digital business model innovation is an IT-enabled, significantly new way of creating and capturing business value, such as Google’s sponsored search ads. Digital process innovation is an IT-enabled, significantly new way of doing things in an organizational setting, such as adopting warehouse automation systems. Digital product innovation is an IT-enabled, significantly new product or service, such as ERP/CRM systems, e-book readers, or smartphones. Fichman et al. (2014, p. 344) further argue that the traditional focus of IS research lies on digital process innovation on the part of adopters, and set an agenda for broadening the scope to the development of digital product innovation. Yoo et al. (2010, p. 725) focus more specifically on digital product innovation, which they define as “the carrying out of new combinations of digital and physical components to produce novel products”. This implies a focus on the

practice (the “carrying out”) of digital innovation, and suggests that digital innovation has at least two distinctive characteristics that differentiate the phenomenon from traditional innovation (Fichman et al., 2014; Yoo et al., 2010).

Firstly, digitization of previously analog information is a necessary but not sufficient condition for digital innovation to occur. Characteristics of digital technologies distinctively shape the form of digital innovation. Through this digitalization, products, processes, and business models inherit properties from the digital technologies they embody, such as increased programmability, malleability, traceability, accessibility, shareability, tailorability, and modularity (Yoo, 2010). In this regard, these unique and distinctive characteristics of digital technologies decisively influence how digital innovation emerges and unfolds (Leonardi, 2011).

Secondly, digital technologies radically transform the nature of established innovation practices on the side of developers and adopters, as they provide an environment of open and flexible affordances that bring forth innovations characterized by convergence and generativity. Here, convergence means that digital innovation brings together previously separate user experiences and industries. Generativity means that digital innovation becomes inherently dynamic and malleable (Yoo et al., 2012). In this regard, digital innovation brings about novel forms of innovating such as combinatorial and distributed innovation. Here, combinatorial innovation refers to how, through recombination of digital artifacts, new products and services with embedded digital capabilities can emerge. Distributed innovation refers to how, due to lower cost of communication and coordination, the innovation practices disperse geographically and move towards the periphery of organizations (Yoo et al., 2012). Accordingly, adopting digital innovation has considerable consequences such as modularity, high switching cost, network effects, Moore’s law, and the digitalization of processes (Fichman et al., 2014).

Taken together, these two aspects put forward that the concept of digital innovation constitutes a good starting point for answering a core question in IS research and education, namely how IT transforms business and society (Dhar and Sundararajan, 2007). This arguably provides an answer to why it matters to study digital innovation and the process of its development (Fichman et al., 2014). However, with few exceptions (see Hylving et al., 2012 for an example from the automobile industry), previous research has not addressed the transformational effects of injecting digital technologies into established innovation practices. Hence we agree with Fichman et al. (2014) that we currently enter a ‘golden age’ of digital innovation, and IS research should now to seize the opportunity of integrating the perspectives of digital innovation and innovation management into one comprehensive approach.

With this study, we contribute to that discourse by taking a practice perspective on digital innovation. A practice perspective facilitates focusing on the work and behavioral intentions of innovating persons, and foregrounds their actual practices (Majchrzak et al., 2012). The underlying assumption is that innovation is not a one-off moment without a history or future, but rather a continuous, ongoing, and collective accomplishment of something people do and enact (Pantzar and Shove, 2010). *Practices* can be defined as “embodied, materially mediated arrays of human activity centrally organized around shared practical understandings” (Schatzki, 2001, p. 2). As a developer or adopter of a given digital technology-based innovation, a person is a carrier of a social practice. In turn, digital technology itself exists only as technology-in-use, embodied in a specific practice. Accordingly, any innovation process, whether digital or not, can only unfold as a sequence of various practices. The appropriate level of analysis to capture the complexity of digitally networked innovation is, therefore, at the level of social practice (cf. Tuomi, 2002, p. 19).

Outside the IS realm, which only recently began to elaborate a body of literature on digital innovation, scholars from the technology and innovation management discipline have brought forth numerous contributions that could benefit from theorizing about digital innovation, too (Yoo, 2013). For instance, the concept of open innovation suggests that self-organizing networks of employees are a crucial driver for the development of complex and innovative digital technologies (Chesbrough, 2003). In an increasingly networked corporate environment (Von Hippel, 2005), a differentiation strategy based on product, process, or business model innovation can be a key source of competitive advantage (Tidd and Bessant, 2011). According to the open innovation paradigm, companies should purposefully use both inflows and outflows of knowledge to accelerate internal innovation and expand the market for external innovation (Chesbrough et al. 2005). Open innovation leads to a decentralization, where companies replace R&D-based with more network-based work structures (Desouza 2011, p. 8-14). Since traditional R&D

departments would only enable selected experienced employees to work on ideas with a long-term impact, ever more companies facilitate collecting ideas from all sides (Neyer et al., 2009). Against this backdrop, idea-driven organizations emerge as increasingly important phenomenon (Robinson and Schroeder, 2014), with companies like Apple or Google providing prominent examples of an entirely novel self-understanding of the employee. Today's leading innovative companies are habitats of so-called *intrapreneurs*, i.e. employees who share the drive and zeal of entrepreneurs, but innovate within the confines of their organization, relying on its technical, financial, and professional resources (Desouza, 2011). For instance, Desouza (2011) conceptualizes the employee-driven innovation process as a circular process that starts with the *Idea Generation & Mobilization* stage, where novel ideas are brainstormed and set in motion, before they become discussable projects competing for funding in the *Advocating & Screening* stage. The funnel gradually narrows down in the *Experimentation* stage where innovators explore solution possibilities and constrain the possible solution stage, before turning the idea from concept to solution and developing a marketing plan in the *Commercialization* stage. Eventually, in the *Diffusion and Implementation* stage the company seeks to push the idea to the farthest corners of the market and show customers how to use the new product or service successfully.

These perspectives have in common that they put the networked innovator into the center of attention, a tradition that dates back to the very roots of research on innovation. In the pioneering works of Schumpeter (1934), on which many digital innovation scholars also rely on, the concept of innovation is tightly intertwined with the person of the *entrepreneur* as a central (and sometimes only) carrier of economic growth and creative disruption. However, Schumpeter lived at a time when industrial processes followed standardized and repetitive patterns, where employees worked off predefined task lists, and innovation was rather an exception than a rule. Nowadays, shrinking innovation cycles and new digital technologies make innovation more constant, networked, and employee-driven (Chesbrough, 2003; Desouza, 2011). In addition, embracing the distinctive characteristics of digital (as opposed to non-digital) innovation gains in importance, since these characteristics also influence the tools that are used and vice versa. Assumptions about stable industries and fixed products would limit the potential of digital technology (Yoo et al. 2012), and we are only at the beginning of understanding the complex interrelations between digital innovation and the practices of digitally networked persons.

### ***Collective Creativity***

The so far presented literature suggests that the concept of digital innovation has the potential to radically renew traditional assumptions and beliefs about innovation. Existing literature on innovation focuses either on characteristics of the individual, on characteristics of the enabling technology, or on the process of innovation. Whereas these perspectives provide helpful starting points exploring innovation processes at the aggregated level of organizations, it has shortcomings regarding the previously described bottom-up emerging, multifaceted, and often serendipitous nature of digital innovation (Andersen, 2008; Hargadon and Bechky, 2006, p. 485). Employee-driven innovation requires a stronger focus on work practices and depends on a variety of influencing factors that are not yet fully understood.

At the heart of each innovation lies an *idea*. Ideas can originate from problem-solving engagements or at random moments; they differ in their scope (e.g. operational, tactical, strategic) the degree of change they impose (e.g. radical or incremental) and their orientation (e.g. internal or external) (Desouza 2011, p. 25-33). Initially, ideas exist only as an abstract conception in someone's mental model, i.e. an intangible and volatile image in the mind of a person (Partridge 1991, pp. 303-304). Only when a person communicates an idea, it meets the realm of reality and becomes a germ cell of innovation. If we want to understand digital innovation, we therefore need to understand how involved stakeholders construct and negotiate ideas in social interaction. One person's practices (such as providing feedback or giving help) shape the practices of another, which then in turn shapes the practices of others. This collaborative aspect of idea development can be explained with *collective creativity*, which is based on the notion that creativity in organizations occurs as a confluence of ideas from multiple sources (Hargadon and Bechky, 2006, p. 486). It puts forward that that creative ideas often do not stem solely from 'eureka' moments of individual cognition, but rather from insights that emerge in interactions between individuals, such as collaborative problem solving. Collective creativity can be an opportunity for organizations to generate creative ideas when people from various domains come together to find, redefine, and solve problems that no one could have done easily alone (Hargadon and Bechky, 2006). But it can also be a challenge because creative ideas

encounter many barriers in organizations, such as resistance from established institutions (Hargadon and Douglas, 2001). Companies that facilitate collective creativity put great effort in creating an environment where employees are willing and able to engage in innovative problem solving (Hill et al., 2014). Prominent examples are the Google's offices with many playful components and relaxation areas (Brown, 2008) and the big atrium in Pixar's central office (Rao et al., 2008). The architecture of the building simply does not allow employees to finish their working day without running into their co-workers, thereby fostering collaboration and facilitating the flow of ideas across organizational units.

These studies imply a strong focus on the way employees connect and network. Social networks play a crucial role in nearly all aspects of organizational life (Agarwal et al., 2008), and as such are also an important part of digital innovation practices. Recent studies consider those innovators as capable who are well connected and collaborate with their personal network of innovators, champions, and gatekeepers (Graf and Krüger 2011, Desouza 2011, p. 72). Fichter (2009) links research on open innovation more closely to the networking practices of innovating persons, who he terms champions and promoters. Based on promotor theory, i.e. the notion that innovation outcomes depend on specific persons (promoters) who help overcoming certain barriers (Hauschildt and Kirchmann, 2001), he introduces the notion of *innovation communities*, which he defines as “an informal network of likeminded individuals, acting as universal or specialized promoters [...] that team up in a project related fashion, and commonly promote a specific innovation” (Fichter, 2009, p. 360). Innovation communities can be differentiated from scientific or R&D communities by their declared goal to promote a specific innovation project. Collective creativity always revolves around a specific idea. In this regard, collective creativity can be seen as the central practice that is carried out by innovation communities.

### ***Idea Hubs as Nexus of Collective Creativity***

The so far presented literature suggests that collective creativity is a central phenomenon in digital innovation, and as such could provide a good starting point for developing its body of theory. In research practice, however, a series of obstacles makes it very difficult to observe collective creativity. Firstly, the ephemeral and punctuate occurrences of collective creativity make it difficult to judge whether a particular interaction between individuals later led to the creative insight that sparked the innovative idea (Hargadon and Bechky, 2006). Secondly, getting deep insights into how social interactions generate team level creative synergy requires ethnographic methods with high involvement of the researcher (Wickson et al., 2006). Thirdly, the dynamic and constantly changing environment within which employees engage in collective creativity occurs requires suitable a theoretical perspective that is lacking so far (Fichter, 2009). For this purpose, our contribution proposes the *idea hub* as a novel perspective to study this multifaceted and complex phenomenon. We define an idea hub as a nexus of collective creativity, where different kinds of employees collectively generate, refine, or extend innovation-ideas online or offline. The word *nexus* itself originates from Latin and means 1) a connected group or series, and 2) a central or focal point. An idea hub as nexus of collective creativity is the focal point where a connected group of employees bind ideas together to generate team level creative synergies.

## **Research Method and Empirical Context**

This section details our research approach. Since our motivation was to understand social networking practices in the context of digital innovation from a participant's perspective, we conducted an interpretive case study (Walsham, 2006, 1995) of innovation practices at two multinational European software companies. In framing the study, we took an interpretive epistemological and ontological stance, in which facts and values are intertwined ingredients of scientific knowledge, and ‘reality-for-us’ is an inter-subjective social construction of the shared human cognitive apparatus (Walsham, 1995, p. 76). As typical for interpretive research, we used an iterative approach to data collection and analysis until a coherent picture emerged, moving back and forth between theories and the different interpretations of the case study material we obtained from social constructions such as language, shared meaning, documents, tools, and other artifacts (Klein and Myers, 1999). Over the course of two years, our approach was to zoom in and out iteratively (Nicolini, 2009) on the innovation practices at the case firms, beginning as an in-depth study in one location and then expanding to another location by following emerging relations, while switching between multiple theoretical lenses when interpreting them (Walsham, 2006).

## Case Selection

Since the above described previous research suggests that practices are especially relevant in innovation processes that are that are employee-driven (Desouza, 2011), involve the confluence of ideas from various sources (Chesbrough 2003), and deal with specific characteristics of digital technologies (Yoo et al. 2010), we selected the cases based on three criteria: 1) high activity of employee-driven innovation 2) high degree of collaboration and 3) high involvement of digital technologies in the development and outcome of the innovation. This lead us to turn to the following two multinational European software companies.

*Banking and IT Solutions (BITS):* Founded in the early 1990ies by a group of software engineers, the company rapidly grew to an international market leader in banking software. Until 2008's financial crisis increased the pressure to innovate and diversify its solution portfolio, the strategic focus of BITS was the development, distribution, and operation of its proprietary core banking system. The executive board became increasingly concerned that the product lifecycle of that system might have peaked, and initiated substantial investments in establishing an internal innovation management framework. In the following years, the strategic focus of BITS became the development of new products, services, and business models in collaboration with customers, external partners, and universities. In the last two years, the company grew from around 600 to more than 1400 employees in two development centers and seven subsidiaries worldwide. It is therefore an appropriate subject for examining collective creativity in digital innovation.

*Custom Software Engineering House (CustomSoft):* An engineering startup founded 1996 as a side project from a group of computer science PhD students. Quite different from BITS, the core business of CustomSoft is to develop large software applications on client order. Customer segments include transport, health, and space agencies, as well as public administration, banks, and insurances. In addition to software development, the around 350 employees offer complementary services such as technical consulting, project management, and requirements engineering. In order to reduce the financial risk that results from the company's high dependence on client orders, the management board constantly seeks to better use the potential of the highly specialized domain knowledge their employees obtain at the customer side. More recently, executives declared it the company's strategy to improve their innovation practices. CustomSoft is therefore an appropriate subject for validating, extending, and refining the company specific findings of the BITS study.

Until today, both companies are commercially successful, as they have achieved continuous growth in revenues, staff, customers, users, and international subsidiaries with their self-made software-based products and services. But they also face the same challenge: A generation of innovative founders who, decades after successfully launching, developing, and nurturing a business, want to hand over power and control to future generations in a way that the company's innovative capacity can be sustainably preserved. For this, they both put emphasis on selective recruiting of university graduates and creating conditions in which employees can realize their creative potential. In both companies, work is largely structured around generating novel solutions to novel problems.

## Data Collection

Our data collection followed the principle of triangulation (Silverman, 2006, p. 291) where we examined the research issue from different sides, compiling multiple interpretations obtained from interviews, observations, field notes, and documentary material into a coherent picture (Klein and Myers 1999). One author engaged in the organizations as involved researcher and collected a considerable amount of data through interviews, online and offline observations, field notes, and collecting documentary data. Over the course of two years, the data collection unfolded as described in the following phases.

In the first phase (02/2013 – 10/2013), *identifying key themes*, the study focused on the way employees communicate ideas across intersecting social worlds. We studied in detail the co-located networking behavior of 32 experts from the BITS headquarters in Switzerland. The first author spent between 2-4 days a week onsite at the BITS headquarter and had access to an in-house workstation and intranet platforms. From there, the author conducted interviews to get an in-depth understanding of the focal phenomenon from a participant's perspective (Miles and Huberman, 1994). In addition, the author attended formal gatherings (meetings, workshops, presentations and fairs), as well as informal gatherings (lunches, impromptu meetings). Executives helped us with identifying an initial set of interview partners. From there, we proceeded with snowball sampling, through the network of personal contacts (Stebbins,

2001). Questions addressed the participants' innovation practices when collaboratively developing ideas, whereat participants were required to use authentic examples of their own experience. In doing so, we identified a series of gatherings where participants connect and network to exchange ideas. A series of participant observations at the identified gatherings followed and, where possible, photographs and field reports complemented the observations. In addition, we systematically analyzed the collected digital documents to identify key themes. This allowed us to make sense of the observed and described situations, and to formulate more specific themes to feed future studies. The first phase ended with writing an interim study report with a status quo analysis, which we presented and discussed with BITS representatives to inform about our findings and frame the next phase.

In the second phase (01/2014 – 12/2014), *validating, extending, and refining constructs*, the study focused in parallel on how BITS and CustomSoft employees collaborate across geographically distributed locations. Platform observation alleviated tracking acts of online networking. The first author continued to spend between 1-2 days a week onsite at the BITS headquarter, and additionally spent between 1-2 weeks in a row onsite at various remote subsidiaries of BITS and CustomSoft respectively, during which he interviewed 30 BITS and 33 CustomSoft experts from subsidiaries in the UK, Macedonia, Singapore, Philippines, France, Luxembourg, and Liechtenstein. Questions addressed the way employees organize and share information about their innovative ideas. We thoroughly analyzed online networking platforms such as Confluence regarding their actual and potential usage for innovation and elaborated a set of key use cases. We observed these online networking platforms and extracted documents related to the innovative projects we identified in the interviews. By triangulating between 1) the primary data from the interviews, and 2) the collected secondary data we extracted from these platforms, we were able to draw a more detailed picture of the actual innovation practices. Thus, we claim part of our contribution as providing an example for analyzing innovation practices. The second phase ended with writing two reports with a catalogue of measures and solution concepts that were presented and discussed with BITS and CustomSoft representatives to identify concrete actions to take in the next phase.

In the third and ongoing phase (from 01/2015), *generating impact through embedded research*, the first author cooperates with BITS project teams on both planning and engineering tasks to simultaneously document the practitioners' practices in detail and transfer the obtained scientific understanding into practice. The analysis in this paper draws exclusively on the collected data from the first two phases, but for the sake of completeness, we mention that the ongoing collaboration with the industry partner also provides us with an opportunity to collect feedback for our emerging claims (Walsham, 2006).

<b>Data Source</b>	<b>1st Phase (02/2013–10/2013)</b>	<b>2nd Phase (01/2014–12/2014)</b>	<b>Total</b>
Interviews	32 with BITS	30 with BITS 33 with CustomSoft	95 Interviews - Total=5677min (Average=59.76, min=19, max=104)
Documents	216 from BITS	202 from BITS 62 from CustomSoft	480 documents - E.g. project documents, wiki pages, online platform content, archival data
Participant Observation	113 days onsite at BITS	50 days onsite at BITS 18 days onsite at CustomSoft	181 days spent onsite the case companies - Attending formal project meetings, workshops, presentations, and maintaining informal contacts - Giving talks, organizing workshops and steering meetings, collaborating with project teams

**Table 1. Overview of Collected Data**

Throughout the whole study, the first author of this paper was the primary responsible of collecting data and writing interim reports episodically, keeping a consistent perspective on the research issue as the academic-industry collaboration evolved. In all, the author conducted 95 semi-structured interviews with experts involved in the innovation practices at BITS and CustomSoft. In addition, we collected in total 480 digital documents from online platforms such as intranet wikis or social media platforms, and conducted a series of participant observations. Using these multiple sources of evidence facilitated drawing a richer picture of innovation practices, hence shedding more light on what innovators actually do through participant observations and document analyses, rather than learning only from what they say they do through interviews.

## Data Analysis and Interpretation

In analyzing the case data, we applied the principle of the hermeneutic circle, which suggests “we come to understand a complex whole from preconceptions about the meanings of its parts and their interrelationships” (Klein and Myers 1999, p.71). As typical for interpretive research, we inductively generated shared meaning from the collected data through qualitative data analyses and interactions between authors and between authors and informants from practice (Walsham 1995, 2006).

We carried out the data analysis collaboratively relying mostly on interview transcripts, collected documentary material, and field reports. Nearly all interviews were audio recorded, transcribed, and processed using a coding scheme developed and continuously refined in MAXQDA. Two out of 95 interview partners refused to audiotape the interview. In these two cases, we coded our written interview notes. 61 Interviews were in German and we translated the quotations. The remaining 34 interviews were in English. 86 interviews were face-to-face, 8 interviews were online using video conferencing, and 1 interview was over the phone. We met in a group of four researchers in weekly focus groups (Krueger, 2009) to maintain a critical distance of the embedded researcher with the case company (Wickson et al., 2006), moving back and forth between data and theories, interrogating field material to check whether the data supported emerging claims, conversely, whether theories helped us making sense of the empirics (Yanow and Schwartz-Shea, 2013). The interviews were recorded and transcribed following a denaturalized approach, which focuses on meanings rather than on accents of the interviewees (Weston et al., 2001). We crosschecked the transcriptions among the research team to increase internal validity, and analyzed the cases for discrepant evidence (Weston et al. 2001). The transcriptions were imported into MAXQDA to facilitate joint analysis and increase confidence in the findings, where two researchers developed a codebook (DeCuir-Gunby et al., 2011). Two additional researchers carried out coding checks to ensure intercoder reliability and develop a shared conception of reflection (Weston et al., 2001). We further elaborated the codebook in weekly focus groups to identify themes from various interviews and derive new codes in vivo from the data (DeCuir-Gunby et al., 2011). Basic coding dimensions included 1) the setting in which employees use idea hubs (e.g. meetings) 2) involved actors 3) the form of the idea hub (e.g. online or offline) 4) the interviewees judgment of the idea hub’s suitability for collective creativity and 5) tools used in the idea hub (such as video conferencing). The coded units were phrases, sentences, or paragraphs (Weber, 1990).

In addition, we provided the case companies with continuous with feedback and opportunities to reflect on their own practice (Walsham, 2006). Having key informants from the companies review our in total four interim study reports enabled them to reflect on our findings and report any discrepancies with their interpretations. We discussed the emerging findings of the study in intensive workshops and presented them at company-internal talks to help practitioners reflect on and improve their own practices.

## Results

Type	Description	
Offline Idea Hub (Collectively creating ideas in co-located formal and informal meetings)	Informal	Spontaneous impromptu gatherings and purposeful casual appointments to discuss early ideas, get feedback, and cultivate social contacts. E.g. coffee breaks, lunches, informal talks.
	Formal	Workshops, presentations, fairs, and contests to persuade potential stakeholders and decide on next steps.
Online Idea Hub (Collectively creating ideas synchronously or asynchronously using collaboration software)	Synchronous	Facilitates idea-related information sharing to merge idea-related information supply and demand.
	Asynchronous	Facilitates time-delayed knowledge work to coordinate meetings, prepare reading material, share meeting minutes, share idea content and collaborate on shared documents.

**Table 2. Overview of Identified Idea Hubs**

This section illustrates the idea hubs in the innovation practices at BITS and CustomSoft, and table 2 provides an overview. We structure our analysis into *offline idea hubs*, where employees collectively create ideas in co-located formal and informal meetings, and *online idea hubs*, where geographically distributed employees collectively create ideas using collaboration software in a synchronous or asynchronous way. In this regard, our study provides not only insights into employees' online networking practices (e.g. with social media), but also into the offline networking practices, as well as the intersection between the two. These different kinds of idea hubs are an important factor in supporting the social networking practices of innovative employees.

### **Offline Idea Hubs**

An offline idea hub is a nexus where co-located employees meet in a formal or informal way to collectively create ideas. Formal hubs are conventional, planned, and rehearsed meetings, with ideas being carefully selected and pronounced. In contrast, informal hubs are unconventional, unplanned, and unrehearsed meetings, with ideas developing freely as the discussion evolves.

*Informal hubs* in innovation practices at BITS and CustomSoft include spontaneous impromptu gatherings and purposeful casual appointments. These are mainly important to informally discuss early ideas and get feedback, but also to make new connections and maintain existing ones. Most employees emphasized the importance of informal meetings for nurturing their social capital, and we observed that different kinds of office arrangements lead to different networking practices. For instance, at BITS' multilevel headquarter offices in Switzerland, employees typically communicate early ideas informally at the coffee corners. Each office store has at least one of these designated open spaces. They feature many playful and casual elements such as video game consoles, beanbags, couches, books, magazines, and whiteboards, as well as free food and beverage dispensers. Here, employees commonly share ideas when doing stand-up meetings, simply running into each other, or using these facilities for 'Apéros', a common Swiss habit of sharing a drink and snacks before dinner. One employee stated "*you always find some time to occasionally discuss ideas over a coffee or at lunch*" [i10, Middle Manager, BITS CH]. Another agrees, "*We discuss ideas over a coffee very often. Really, coffee is extremely important*" [i42, Consultant, BITS CH]. In turn, at BITS' open plain offices in the UK, informal meetings often start as gatherings of two or three people discussing an issue, then attracting further interested employees to join the discussion and share their ideas. One employee stated:

We are open plain here. Everyone can see each other. There is a bit more of a less formal environment about it. In Switzerland, you poke your head around in someone's room whereas here, you just walk over to their desk. [i50, Middle Manager, BITS UK].

At CustomSoft's Swiss headquarter, where open plain offices are spread across different facilities, employees often share ideas when running into each other between buildings, if they feel they are in a trusted environment:

I have some peers where I can place my ideas without any risk. That's usually over a coffee, when walking over to the canteen, or at the tabletop soccer. [...] They are good listeners but also busy people, so they do not push me all the time. [...] But there are also people who I call the preventers of everything. And with these preventers I am careful with even mentioning the idea, because they often not only have the potential to choke off the idea, but also to choke off my motivation" [i85, Software Engineer, CustomSoft CH].

In addition, many employees at both companies arrange recurring or occasional casual appointments such as breakfast meetings, brown bag lunches, or 'tech talks' with internal or invited speakers presenting recent topics. Most employees perceive such events as fruitful sources for ideas, as one employee describes:

I often network after a tech talk or at a [breakfast] meeting, when I run into someone [...] and say 'hey, what did you think about that?' Then you have a little bit of open discussion, and they say 'yeah, we had another idea there' [i34, Project Manager, BITS CH].

*Formal hubs* in innovation practices at BITS and CustomSoft include workshops, presentations, fairs, and contests. These are mostly important to persuade potential stakeholders and decide on next steps. For instance, both BITS and CustomSoft have designated 'innovation board' committees of selected

experienced employees from various organizational units. These committees organize regular audition meetings where proactive employees can present ideas, get reviews with suggestions on next steps, build social coalitions with collaborators and influential advocates, and possibly obtain funding. In both companies, the innovation board purposefully organizes various events to foster employee-driven innovation. For instance, the BITS innovation board organizes a yearly 'idea fair' where employees are asked upfront to submit a filled in factsheet to a call for ideas. After an initial screening, the innovation board invites authors of the eight most promising ideas to create a poster presentation. The CEO and various executives then inaugurate the idea fair with a keynote, followed by employees walking around the various poster booths, where authors present the ideas. Afterwards, employees vote for ideas and the innovation board audits the most voted ones for further funding. The CustomSoft innovation board also organizes contests where students compete with ideas for prizes: "*We have two online rounds and one on-site round, where 32 finalists are competing for nice prizes like a trip to Jazoon with all expenses covered.*" [i70, Senior Manager, CustomSoft]. In addition, the innovation boards also maintain internal online idea platforms, which we describe in detail in the following section. Employees perceive these innovation boards in quite different ways. Some appreciate the possibility to bring in ideas and see the innovation board as facilitator, catalyst, and network expander. Others criticize the innovation boards' lack of decision authority and structured processes to realize an idea and see them rather as unnecessary gatekeeper and pre-filter of the executive board

There is one easier way, namely you need a customer. If a customer funds your idea, you bypass many things. [Otherwise] it happens that the innovation board approves and then the executive board rejects it [i10, Middle Manager, BITS CH].

In this regard, the innovation boards seem to be caught in between top-down and bottom-up innovation. In addition, many employees attend academic and practitioner conferences such as the International Conference on Software Engineering (ICSE), the German Wirtschaftsinformatik conference (WI), Jazoon, or Java User Groups (JUGs):

I like conferences because they are good for meeting new people and topics. People who present at a conference usually have more fire for a topic. I also give talks myself, and that is even better for networking. People approach you who are actually interested. [i93, Senior Manager, CustomSoft CH].

Some groups of employees also organize different kinds of retreats where they gather for a weekend in remote locations such as alpine huts to discuss recent innovative social, economic, or technical developments at so-called symposia, or to collectively tinker and experiment with novel technologies at so-called code camps.

### **Online Idea Hubs**

An online idea hub is a nexus where distributed employees collaborate using IT artifacts to collectively create ideas in a synchronous or asynchronous way. Synchronous hubs are settings in which employees collaborate using online media simultaneously. Asynchronous hubs are settings in which employees use online media to work time-delayed with each other. Both synchronous and asynchronous hubs are important for exchanging and producing idea-related information.

*Synchronous hubs* in innovation practices at BITS and CustomSoft facilitate idea-related information sharing with social media, office web applications, and telecommunications software for instant messaging, (video) calls, and file exchange. These are mainly important to merge idea-related information supply and demand. Employees in both companies frequently use telecommunications software such as Microsoft (MS) Lync, Citrix GoToMeeting, or Jabber.org to ask questions, discuss issues, request feedback, make formal or informal appointments, or create topical chat groups. Emails often serve as a trigger for collaboration, to quickly call for feedback, to ask questions, and send requests: "*When I push information by email, I get more feedback.*" [i40, Senior Manager, BITS CH].

Using video conferencing, employees often conduct online meetings to discuss ideas: "*Based here in [the UK], I can't always be travelling. So I communicate a lot over video conferencing with my team in [Switzerland].*" [i58, Middle Manager, BITS UK]. However, many employees emphasize that web cams should accompany any online meeting to focus the discussion more and be sure to have the opposite's undivided attention. Especially when communicating ideas, having distracted opposites would be inhibiting, as an employee stated:

[Adding video to calls] takes away some of the temptation for people to go off and do other things. [There are also] special rooms with cameras, dedicated facilities that increase the feeling of working together with people in other locations. You all go into that conference room and then you focus. You're not at the desks, surrounded by papers. [i44, Senior Manager, BITS UK].

Another employee adds that visual and, whenever possible, face-to-face communication is more appropriate for persuasion:

You normally need face-to-face contact. People think video conferencing, telephone, and emails heal all wounds and lead to the same result in any case. For me, it is much easier to convince people that an idea is cool and that they should engage in it using facial expressions, and not only two dimensional videoconferencing expressions". [i79, Sales Manager, CustomSoft].

Perhaps this might explain why social media such as Facebook, Twitter, or LinkedIn only play a minor role in innovation practices at BITS and CustomSoft. Though both companies maintain official social media channels for news publishing, event management, and staff recruiting, and few employees occasionally use social media to ask questions about projects they work on, our study found practically no evidence of using social media as a nexus of collective creativity. One employee even states cynically: "What would I get if my idea got 100 likes? Would I then get the resources to realize the idea? If I got 100.000 franks for 100 likes I would try it maybe" [i25, Technical Lead, BITS CH].

In addition, many employees collectively and concurrently create ideas using office web applications such as Google Docs or MS Office 365, with browser-based word processors, spreadsheets, presentation software, and note taking tools. One advantage of these is the ease of distributed synchronous collaboration, as one employee stated:

[In my team we] typically start with a whiteboard discussion and afterwards we use Google Docs. We made very positive experiences with [such tools] because many people can contribute simultaneously and notice if something is not usable. I think good ideas evolve more often in collaboration. Someone has a spark and then it gets to a first discussion, and then you must involve the whole team instead of writing a long document which you then send to a review" [i28, Technical Lead, BITS CH].

The many participant observations we conducted in workshops and meetings at BITS provided further empirical evidence of the use of synchronous hubs. Many employees appreciated the possibility to collaboratively edit wiki pages in meetings, while a beamer displays the page to all attendees.

*Asynchronous hubs* in innovation practices at BITS and CustomSoft facilitate time-delayed knowledge work with idea wikis, reviewing systems, and issue trackers. At BITS as well as CustomSoft, employees extensively use wikis such as Atlassian Confluence to coordinate meetings, prepare reading material, share meeting minutes, share idea content and collaborate on shared documents. As previously mentioned, both BITS and CustomSoft have innovation boards that maintain designated idea wikis. The CustomSoft idea wiki is an open platform where all employees can submit, view, edit, and comment on ideas. All employees are allowed to use a few working days to initiate an idea site, and blue-sky thinking ideas are explicitly encouraged. The start page features an activity stream, depicting the ideas to which members contribute frequently. In addition, the CustomSoft innovation board uses the idea wiki to track a project's status. As with the innovation boards, employees' opinions about the idea wiki diverge, too. On one hand, this openness has led to a substantial amount of several hundred submitted ideas and employees appreciate the democratic character of the platform. This would also contribute to employee motivation and satisfaction: "*our [idea wiki] is an important instrument. When someone posts an idea there, I always try to at least like or comment it. That's an encouragement aspect*" [i93, Senior Manager, CustomSoft CH]. Others criticized a resulting glut of half-baked ideas without a clearly structured realization concept behind. If at all, only those ideas that influential employees submitted would have been realized. Referring to such an idea that has been initiated by an executive board member and then realized, one employee criticized:

One could say that the idea was simply that much better than others. But I have seen many other good ideas that did not get the same support. I think that was not only because of the idea quality, but also because [he has] the best network of all. Many people respect him a lot. [i85, Software Engineer, CustomSoft CH].

Moreover, allowing all community members to provide feedback has led to several frustrated employees who got negative feedback or even worried that their ideas would be stolen.

Many employees at BITS confirm that the involvement of certain influential individuals has significant impact on the outcome of an idea. Two of the BITS innovation board members even stated that stakeholder management would be as important as having good ideas. This can be both beneficial and detrimental at the same time. Some say, such key persons can give strong support, help overcome barriers, and let others benefit from their experience, as one employee stated:

There are certainly some key persons up there, [...] well-established opinion leaders, who must carry an idea or it has little chances. But that's actually normal and okay. Ultimately, these are the really good people, the seniors, who are able to turn some foolish thought into a concrete, good idea. [i1, Software Engineer, BITS CH]

Others rather criticize that certain key persons can be big barriers themselves. Referring to two such key persons within the company, one employee states:

I do like [S.] and [J.] a lot, and one must say they are extremely intelligent and competent; they have achievements that others would not have achieved in a thousand years. But these are exactly the people who are extremely hostile to an innovation if it was not their own idea. [i24, Partner, BITS].

In contrast to CustomSoft's open idea wiki, the BITS idea wiki is a rather closed platform where innovation board members only publish information about those selected ideas that have been presented at the idea fair, and ideas typically relate to a previously predefined area of the company's strategy. An idea wiki page contains a 5-minute video presentation, the poster, additional information in text, and a comment function. The idea wiki manager stated:

We realized we should give people a platform where they can collect the ideas that float around in this company, so they can generate ideas on a broad base and build coalitions [...] and not only the people 'up there' [i32, Manager, BITS CH].

Still, some sharp tongues criticized that the accepted ideas were only those that incrementally contributed to the strategic areas the executive board previously defined. In short, the idea wikis seem to reflect on the innovation boards' top-down/bottom-up dilemma.

Issue trackers are a further, perhaps rather unintentional, asynchronous idea hub at BITS and CustomSoft. Originally, issue trackers are intended to manage the reception, affirmation, processing and documentation of customer and/or internal tickets like change-, support-, or functional requests, and trouble reports. However, many employees have appropriated these tools so extensively in their daily work practices that they often misuse them as online idea hub. Because users can subscribe to issues and get notifications when something changes, employees often use this daily work tool for tracking and anchoring idea-related discussions. One employee stated:

An issue tracker is good for when you first have an idea [because] you always have a central point of communication. Whenever you email someone, you can start your email with a link to the issue. It is a good place for storing the different versions of the artifacts in there, as well. [i60, Software Engineer, BITS UK].

At selected units in BITS, employees can use ten percent of their working time to create issue tracker tickets for their idea and implement them. These tickets are then checked and prioritized by a manager, who stated: "*The idea is to enable incremental product innovation*" [i6, Technical Lead, BITS CH].

## **Discussion**

In the previous section, we provided rich insights into digital innovation practices at the two multinational software providers BITS and CustomSoft. We can confirm that in the dynamic and constantly changing software industry, innovation is increasingly characterized by network-based work structures (cf. Chesbrough, 2003; Desouza, 2011; Von Hippel, 2005). This requires people with different backgrounds to work together across organizational boundaries. However, aligning disparate innovation communities with different kinds of specialized knowledge is challenging, particularly when creating novelty (Majchrzak et al., 2012). This paper adds to the body of knowledge on digital innovation in that it

identifies specific practices that foreground the bottom-up emergence of ideas that are collectively created in various settings. We structured our analysis of social networking in digital innovation practices at BITS and CustomSoft into online and offline idea hubs. Our results provide an empirical account of individuals' choice of idea hubs in various digital innovation practices, on which we elaborate more explicitly in the following.

**Implications for Digital Innovation Research**

This section starts with dialectically examining the identified idea hubs' appropriateness in different contexts, and corroborating these insights with theory. We then present and discuss three influencing factors of idea hub choice that emerged as important from our analysis, namely 1) the role of the infrastructure and its material characteristics in which the idea hub is situated, 2) the role of the innovation process phase in which the idea hub is selected, and 3) personal characteristics of the participants that are connected through the idea hub. Table 3 provides an overview of these.

Construct	Influencing Factor	Description	Data Source
Idea Hub Choice	Material Infrastructure	Individuals choose idea hubs depending on how infrastructural arrangements allow collective creativity to unfold.	Documents, Interviews
	Innovation Process	Individuals choose idea hubs depending on the necessary formality of interaction, which tends to increase with advancements in the innovation process phase.	Interviews, Participant Observations
	Personal Characteristics	Individuals choose idea hubs depending on the possibility to involve influential promoters (Fichter 2009) or catalysts (Tortoriello et al. 2014).	Interviews, Participant Observations

**Table 3. Idea Hub Choice and Influencing Factors**

**The Dialectics of Idea Hub Choice**

Employees can choose from a variety of idea hubs to engage in collective creativity. These idea hubs can be more or less appropriate depending on a variety of factors, as we elaborate in the following critical dialectical examination of the illustrated practices around idea hubs.

As our study shows, employees often use co-located informal idea hubs for establishing and maintaining social connections, for freely generating ideas, and for getting first feedback in a trusted environment. They frequently choose these casual gatherings to get a feeling of whether further persuading an idea could be worthwhile or not, as for instance reflected in the observed practice of discussing ideas in coffee corners. However, while such idea hubs tend to be suitable settings for getting feedback, they tend to be less suitable for making concrete decisions on further steps. When employees feel the idea is ready for invoking more impact, they often turn to more formal gatherings such as board meetings, fairs, or conferences, where they can place ideas more prominently and possibly obtain needed resources, but also risk getting negative feedback that can ultimately stop the idea. Conflicts can arise when there exist multiple gates within a company, which impose divergent views on the idea, as the tension between the innovation boards and executive boards in both companies reflected. The top-down/bottom-up conflicts that arose in both companies indicate political tensions in employee-driven digital innovation.

Online idea hubs facilitate the confluence of ideas from various locations, and expand the personal network on which the employee can draw. Synchronous online collaboration tends to be more appropriate for quickly producing idea-related outcomes, and can in many situations complement formal or informal offline communication. Some configurations can even lead to high degrees of collective creativity, as employees' appraisal of simultaneous collaboration on documents using office web applications indicates. However, as employees' criticism of online communication reflects, synchronous online communication has more sources of distraction and is therefore often less focused, especially if visual aids such as video conferencing are missing. Because interactions are less rich, it tends to be harder to facilitate the

necessary degree of informality that often leads to creative discussions. Many employees complemented co-located interaction in workshops or fairs with distributed interaction for idea generation, coalition building, and fund raising. This observation is consistent with previous propositions that suggest face-to-face communication and co-presence are a must for sharing specialized knowledge, developing mutual trust, and reaching common understanding (Fichter 2009; Gerybadze, 2003, p. 155).

Media choice theories, such as social presence theory and media synchronicity theory, can explain these observations. Social presence theory is based on the notion that individuals make rational media choices based on the allowed degree of social presence, i.e. the possibility to communicate one's personality and non-verbal cues (Short et al., 1976). This notion explains well why many employees complemented co-located with distributed idea hubs when engaging in collective creativity. Given that people tend to make sense of new things based on their existing mental model (Hargadon and Douglas, 2001), communicating ideas requires the sender to persuade the recipient of the novel idea's value, and that can be better achieved in face-to-face communication through its higher degree of social presence. The basic idea behind social presence theory has later been refined in media synchronicity theory, which is based on the notion that individuals make rational media choices based on the allowed degree of synchronicity, i.e. the degree to which multiple persons can work on the same task simultaneously (Dennis et al., 2008; Dennis and Valacich, 1999). This notion explains well why employees in our study often complemented synchronous idea hubs (such as chat, video conferencing, or office web applications) with asynchronous idea hubs (such as issue trackers, wikis, and social media) for distributed collective creativity.

### ***Influencing Factors of Idea Hub Choice***

**Material Infrastructure:** Infrastructural arrangements influence how collective creativity unfolds within idea hubs. For instance, many employees at BITS CH described coffee corners as particularly important sources of collective creativity. Here, people with different roles, different backgrounds, and different views can gather to share and exchange ideas informally. In a similar way, the 17<sup>th</sup> and 18<sup>th</sup> century coffee houses are today considered crucial for proliferating the Age of Enlightenment (Johnson, 2010). In turn, open plain offices are often a stage for contagious discussions. At times, slightly different configurations of spatial arrangements can lead to significantly different outcomes. For instance, the different configurations of the BITS idea wiki and the CustomSoft idea wiki led to different manifestations of collective creativity. The varying degrees of platform openness had an influence on the quantity, scope, and outcome of submitted ideas. At CustomSoft, everybody could contribute to the idea wiki and governance structures were flat. This led to more democratized innovation and blue-sky ideas, but also to a lack of structured processes, which ultimately resulted in a situation where those ideas that influential individuals carried had a better realization chance. At BITS, only selected employees centrally managed the idea wiki and governance structures were hierarchical. This facilitated better focus on the selected ideas, but led to a situation where only incremental ideas were pursued that had only limited added value to previously defined strategic innovation projects.

The constituting role of material infrastructure for collective creativity in digital innovation relates to the recently ongoing sociomateriality debate (cf. Cecez-Kecmanovic et al., 2014 for an overview). In IS research and neighboring disciplines, practice-based studies have gone hand in hand with a parallel emphasis on the social and material nature of organizational practices (Faulkner and Runde, 2013; Leonardi, 2013; Orlikowski and Barley, 2001). As Orlikowski (2007) puts it, the practice lens unveils that “materiality is integral to organizing, positing that the social and the material are *constitutively entangled* in everyday life” (p. 1437, italics in original). IS researchers have further argued that practices can be seen as outcome of the relationship between human agency and material characteristics of technology in use (Leonardi, 2011; Orlikowski and Scott, 2008). In this view, functional affordances of technological objects are essential material properties that facilitate the performance of some action in a specific use context (Markus and Silver, 2008). This helps to explain the observed complex interrelations between employees' networking and characteristics of material infrastructure that surrounds them, and thereby helps to specify how digital innovation changes traditional ways of innovating (Fichman et al., 2014; Yoo et al., 2010).

**Innovation Process:** Innovation process phases influence how collective creativity unfolds within idea hubs. Employees tend to seek unstructured and informal interactions in early innovation process phases, such as *Idea Generation & Mobilization* or *Advocacy & Screening* (cf. Desouza 2011). In our study, many

employees shared early ideas only with people they trust, as for instance one employee's comparison of 'peers and preventers' reflects. However, structured and formal interactions with meetings, workshops, and fairs become more appropriate as the idea matures and proceeds to later innovation process phases, such as *Experimentation* or *Commercialization* (cf. Desouza 2011). In our study, the degree of interaction formality and employees' readiness to step out increased as the idea matured. This process of interaction formalization and structuration suggests that mutual trust plays an important role in collective creativity. Seeking help from others requires an environment of psychological safety and trust, as it implicitly reflects the tacit confession that one is unable to solve problems on one's own (Edmondson, 1999; Hargadon and Bechky, 2006). The willingness to help others requires according reward structures and codes of conduct (Amabile et al., 2014). In addition, these observations suggest that collective creativity requires continuous networking which changes in its nature over time. This insight may also be helpful when facilitating open innovation. Online support such as crowdsourcing platforms may be useful in early innovation phases, but in later phases personal offline support that facilitates rich personal interaction is necessary whenever important decisions are made.

**Personal Characteristics:** Personal characteristics, such as occupational roles, reputation, personality, and organizational influence of the participating individuals influence how collective creativity unfolds within idea hubs. One overall goal of innovation management at BITS and CustomSoft is to increase the number of valuable innovative ideas that are created and developed within the company. Who creates and decides upon these ideas plays an important role in this context. Our results suggest that the involvement of influential individuals plays an important role in both companies' digital innovation practices. A number of employees point to the strong connection between an idea and the person who carries it. To some extent, this aspect might stem from the fact that the founders of the company are still present and influential. Such key characters and those people that work closely with them have substantial influence as both idea providers and idea gatekeepers. Some perceive this as positive because these key characters are also those with the most experience in judging and realizing an idea's potential value. Others criticize that this would lead to less democratic innovation processes where good ideas by less established employees would not be valued enough. This can frustrate new talents and, in the worst case, lead to a situation where the innovative capacity of a company cannot be sustained after an executive changeover.

Promotor theory and the complementary innovation catalyst theory can explain these observations. Promotor theory is based on the notion that innovation success depends crucially on networked individuals, so-called promoters, who actively and intensively support the innovation process (Witte, 1973, p. 15). They do so by providing certain resources, such as specialized knowledge, organizational influence, communication skills, and networking competencies, to overcome certain barriers, such as administrative hurdles, or lack of resources (Fichter, 2009, p. 360). Innovation catalyst theory broadens this scope from active individuals to individuals who play a passive role in innovation processes by supporting, facilitating, and promoting the innovativeness of their colleagues. Catalysts of innovation are individuals "who are able to stimulate and enhance the development of new ideas in their colleagues by providing them with relevant knowledge and who are recognized by their colleagues as key contributors to the process of generating innovations" (Tortoriello et al., 2014, p. 2). Taken together, these two perspectives explain the observed importance of individuals who actively promote ideas on one hand, and individuals who passively support the innovation process on the other hand. However, while it can be an advantage that influential promoters and catalysts at BITS and CustomSoft carry ideas, it can also become a problem if promising new ideas are suppressed in the company's social network. Many employees pointed to the seemingly paradox character of some influential persons, who can be decisive promoters or catalysts in one situation, but in another moment the same person can be a preventer who can choke-off a good idea. This explains well why one employee criticized that having 'likes' in a social media platform may not be sufficient, and why innovation has not become a purely digital practice at BITS and CustomSoft, although both companies' business model is based on digital products and services. Digital artifacts are important to support those practices that are primarily physical (such as videoconferencing for visual meetings), and interpersonal relationships play a crucial role in choosing an idea hub.

### ***Implications for Digital Innovation Practice***

Digital innovation confronts firms with shortened product cycles, high demands on time to market, increased competition through distributed communities and digital platforms (such as app stores), and last but not least increases the competition for highly skilled professionals. Against this backdrop, ever

more companies place a stronger focus on fostering employee-driven innovation, thereby creating various new opportunities but also placing new challenges. On the one hand, middle managers (e.g. business analysts, product managers, project managers) in the software industry are increasingly faced with the difficult challenge of balancing between organizational efficiency, stability, and innovativeness. On the other hand, innovative employees are required to carry out original combinations of digital components, be creative, break free from extant thinking patterns, deal with high degrees of uncertainty, and overcome resistance to change. Despite the wide diffusion of literature suggesting best practices, managing innovation remains a major challenge for companies, and the nearly countless possibilities offered by new digital technologies do not make that task any easier. Our study suggests that any restructuring endeavor would benefit from explicitly supporting and fostering social networking practices through targeted implementation of idea hubs within the organization.

Our analysis of idea hubs yields rich insights into the digital innovation practices at two firms. These rich insights may be transferred to other contexts as well and help a broader class of firms to reflect on and improve their practices. For instance, the idea hubs we identified suggest specific ways in which employees can engage in collective creativity, if a company explicitly wants to encourage them to do so. We suggest that our contribution allows managers to better understand the importance of idea hubs as supporting devices of collective creativity that have to be nurtured and maintained, such that they can facilitate employee-driven innovation. Employees can draw on our contribution to better understand the importance of networking in innovation, how their choice of idea hubs depends on various factors, and how their choice leads to different outcomes. In that regard, this paper illustrates challenges and opportunities regarding the choice of idea hubs. Moreover, designers of collaboration systems can use our contribution to better understand the social contexts in which their tools are used for online networking and distinguish important from unimportant practices, as well as help specify the reasons for unfaithful use. In this regard, the described practices around idea hubs seem to be a good starting point for designing better innovation support, and for analyzing why many well-intentioned management approaches do not automatically result in well-executed innovation practices.

### ***Limitations***

We specified the digital innovation practices at two multinational European software companies, both culturally innovative but not necessarily innovation leaders. In this regard, we do not claim to have provided 'best' practices for digital innovation. Instead, part of our contribution is to identify existing innovation practices and subject them to a critical dialectical examination of their appropriateness for digital innovation. Further empirical work might be necessary to determine whether the identified practices are specific to the software companies BITS and CustomSoft, or whether the observed idea hub dialectics also hold in other contexts and conditions, for example in industrial manufacturing or research institutions. The uniqueness of our sample has provided us with an opportunity to identify a social networking perspective on digital innovation. In doing so, we have obtained relatively detailed insights into the actual mindful interactions between individuals who engage in collective creativity. Whereas these insights offer possibilities to deeper understand digital innovation practices, they alone do not offer comprehensive prescriptions on how these practices should ideally be supported. Further research could draw on our contribution to examine how leading innovative companies engage in collective creativity to identify best practices and structured guidance for innovation.

This study focused on how employees engage in collective creativity to practice digital innovation. However, creativity and innovation do not only result from group practices. In line with previous research on collective creativity (Hargadon and Bechky, 2006), we do not disagree with the long prevailing picture of the solitary entrepreneur as main driver for innovation (Schumpeter, 1934). There may be no simple answer to the question whether genuine innovative ideas result rather from 'eureka' moments or from continuous networking practices.

## **Conclusion and Outlook**

We set out to explore two software companies' digital innovation practices from a social networking perspective, focusing on the networking of employees who actively and enthusiastically promote ideas. Our analysis of idea hubs as nexus of collective creativity shows how employees choose from a variety of online and offline idea hubs, depending on infrastructural, individual, and process-related aspects. In this regard, this paper specifies social networking practices and, thereby, contributes to explain why employees often appropriate tools such as enterprise social media in ways that are quite different from the intended ones. In times where ESM play an increasingly important role and gain growing research attention, one should still bear in mind the major role of offline networking and human aspects.

This implies thought-provoking impulses for shaping a vision of society in the digital age. Digital artifacts provide numerous new possibilities for individuals, organizations, and economies. They afford novel forms of innovation practices in general, and social networking in particular. However, we would question whether digital technologies would eventually transform every important aspect of modern social life. In our study of digital innovation practices at two software companies, offline interactions still played a major role, particularly when important decisions were necessary. Digital technologies should therefore be in line with the emergent character of innovation practices to fully unfold their potential. There is still potential to support formal and informal networking. We therefore suggest future research and practice to also think of the broader shift in perspective, namely from managing and controlling centrally planned innovation processes to facilitating and enabling digitally networked innovation practices.

With this study, we identified and developed the idea hub as a novel theoretical perspective on the nexus of collective creativity. In doing so, we illustrated the environmental factors that influence the performance of such idea hubs, and how individuals choose them. For this purpose, we chose qualitative methods and inductive theory building to identify and describe the phenomenon. Further quantitative work could develop metrics and test the suggested interrelations and their relative effects, for instance in laboratory experiments or with surveys.

Our contribution suggests extensions to the existing literature on digital innovation. It helps explain the bottom-up emergent nature of digital innovation, enacted in the individual practices of employees; it advocates a revised appraisal of the role social networking plays in innovation practices; it illustrates a systematized account of how innovators enact practices with idea hubs; it facilitates a deeper understanding of how the active and passive roles of social networks can be unpacked; it provides an example for systematically analyzing networking practices in organizations, embracing formal, informal, online, offline, synchronous and asynchronous collaboration; and puts focus on organizational environments that favor collective innovative minds.

## **Acknowledgements**

We would like to thank the employees of BITS and CustomSoft for their openness and support during the study. We further thank Gerhard Schwabe for providing helpful comments on an earlier version of this manuscript.

## References

- Agarwal, R., Gupta, A.K., Kraut, R., 2008. Editorial Overview—The Interplay Between Digital and Social Networks. *Information Systems Research* 19, 243–252. doi:10.1287/isre.1080.0200
- Amabile, T., Fisher, C.M., Pillemer, J., 2014. IDEO's Culture of Helping. *Harvard Business Review* 92, 54–61.
- Andersen, O.J., 2008. A Bottom-Up Perspective on Innovations Mobilizing Knowledge and Social Capital Through Innovative Processes of Bricolage. *Administration & Society* 40, 54–78.
- Brown, T., 2008. Tales of creativity and play, TED Talks. [http://www.ted.com/talks/tim\\_brown\\_on\\_creativity\\_and\\_play?language=en](http://www.ted.com/talks/tim_brown_on_creativity_and_play?language=en).
- Brown, T., n.d. Tales of Creativity and Play.
- Cecez-Kecmanovic, D., Galliers, R.D., Henfridsson, O., Newell, S., Vidgen, R., 2014. The Sociomateriality of Information Systems: Current status, future directions. *MIS Quarterly* 38, 809–830.
- Chesbrough, H.W., 2003. Open innovation: The new imperative for creating and profiting from technology. Harvard Business Press.
- DeCuir-Gunby, J.T., Marshall, P.L., McCulloch, A.W., 2011. Developing and using a codebook for the analysis of interview data: An example from a professional development research project. *Field Methods* 23, 136–155.
- Dennis, A.R., Fuller, R.M., Valacich, J.S., 2008. Media, tasks, and communication processes: A theory of media synchronicity. *MIS quarterly* 32, 575–600.
- Dennis, A.R., Valacich, J.S., 1999. Rethinking media richness: Towards a theory of media synchronicity, in: *Systems Sciences, 1999. HICSS-32. Proceedings of the 32nd Annual Hawaii International Conference on. IEEE*, p. 10–pp.
- Desouza, K.C., 2011. *Intrapreneurship: managing ideas within your organization*. University of Toronto Press.
- Dhar, V., Sundararajan, A., 2007. Issues and Opinions-Information Technologies in Business: A Blueprint for Education and Research. *Information Systems Research* 18, 125–141.
- Edmondson, A., 1999. Psychological safety and learning behavior in work teams. *Administrative science quarterly* 44, 350–383.
- Faulkner, P., Runde, J., 2013. Technological Objects, Social Positions, and the Transformational Model of Social Activity. *MIS Quarterly* 37, 803–818.
- Fichman, R.G., Dos Santos, B.L., Zheng, Z. (Eric), 2014. Digital Innovation as a Fundamental and Powerful Concept in the Information Systems Curriculum. *MIS Quarterly* 38, 329–A15.
- Fichter, K., 2009. Innovation communities: the role of networks of promoters in Open Innovation. *R&D Management* 39, 357–371.
- Gerybadze, A., 2003. Gruppendynamik und Verstehen in Innovation Communities, in: *Management Der Frühen Innovationsphasen*. Springer, pp. 145–160.
- Hargadon, A.B., Bechky, B.A., 2006. When collections of creatives become creative collectives: A field study of problem solving at work. *Organization Science* 17, 484–500.
- Hargadon, A.B., Douglas, Y., 2001. When innovations meet institutions: Edison and the design of the electric light. *Administrative science quarterly* 46, 476–501.
- Hauschildt, J., Kirchmann, E., 2001. Teamwork for innovation—the “troika” of promoters. *R&D Management* 31, 41–49.
- Hill, L.A., Brandeau, G., Truelove, E., Lineback, K., 2014. Collective genius. *Harvard business review* 92, 94–102.
- Hylving, L., Henfridsson, O., Selander, L., 2012. The Role of Dominant Design in a Product Developing Firm's Digital Innovation. *Journal of Information Technology Theory and Application (JITTA)* 13, 2.
- Johnson, S., 2010. Where do ideas come from?, TED Talks. [https://www.ted.com/playlists/20/where\\_do\\_ideas\\_come\\_from](https://www.ted.com/playlists/20/where_do_ideas_come_from).
- Klein, H.K., Myers, M.D., 1999. A set of principles for conducting and evaluating interpretive field studies in information systems. *MIS quarterly* 67–93.
- Krueger, R.A., 2009. *Focus groups: A practical guide for applied research*. Sage.
- Leonardi, P.M., 2013. Theoretical foundations for the study of sociomateriality. *Information and Organization* 23, 59–76.

- Leonardi, P.M., 2011. When flexible routines meet flexible technologies: Affordance, constraint, and the imbrication of human and material agencies. *MIS quarterly* 35, 147–167.
- Majchrzak, A., More, P.H.B., Faraj, S., 2012. Transcending Knowledge Differences in Cross-Functional Teams. *Organization Science* 23, 951–970. doi:10.1287/orsc.1110.0677
- Markus, M.L., Silver, M.S., 2008. A foundation for the study of IT effects: A new look at DeSanctis and Poole's concepts of structural features and spirit. *Journal of the Association for Information Systems* 9, 609–632.
- Miles, M.B., Huberman, A.M., 1994. *Qualitative data analysis: An expanded sourcebook*. Sage.
- Nambisan, S., 2003. Information systems as a reference discipline for new product development. *Mis Quarterly* 1–18.
- Nambisan, S., Lyytinen, K., Majchrzak, A., Song, M., 2014. *Information Technology and Innovation*. Call for Papers: MIS Quarterly Special Issue "IT and Innovation."
- Neyer, A.-K., Bullinger, A.C., Moeslein, K.M., 2009. Integrating inside and outside innovators: a sociotechnical systems perspective. *R&D Management* 39, 410–419.
- Orlikowski, W.J., Barley, S.R., 2001. Technology and institutions: what can research on information technology and research on organizations learn from each other? *MIS quarterly* 25, 145–165.
- Orlikowski, W.J., Scott, S.V., 2008. Sociomateriality: Challenging the Separation of Technology, Work and Organization. *The academy of management annals* 2, 433–474.
- Rao, H., Sutton, R., Webb, A.P., 2008. Innovation lessons from Pixar: An interview with Oscar-winning director Brad Bird. *McKinsey Quarterly* 1–9.
- Robinson, A.G., Schroeder, D.M., 2014. *The Idea-Driven Organization: Unlocking the Power in Bottom-Up Ideas*, 1 edition. ed. Berrett-Koehler Publishers, San Francisco.
- Sawhney, M., Nambisan, S., 2007. *The global brain: Your roadmap for innovating faster and smarter in a networked world*. Pearson Prentice Hall.
- Schatzki, T.R., 2001. Practice theory, T. R. Schatzki, K. Knorr-Cetina, & E. von Savigny (Eds.), *The practice turn in contemporary theory* (pp. 1–14). London/New York: Routledge.
- Schumpeter, J.A., 1934. *The theory of economic development: An inquiry into profits, capital, credit, interest, and the business cycle*. Transaction publishers.
- Short, J., Williams, E., Christie, B., 1976. *The social psychology of telecommunications*.
- Stebbins, R.A., 2001. *Exploratory research in the social sciences*. Sage.
- Tidd, J., Bessant, J., 2011. *Managing innovation: integrating technological, market and organizational change*. John Wiley & Sons.
- Tortoriello, M., McEvily, B., Krackhardt, D., 2014. Being a Catalyst of Innovation: The Role of Knowledge Diversity and Network Closure. *Organization Science*. doi:10.1287/orsc.2014.0942
- Tuomi, I., 2002. *Networks of innovation*. Oxford University Press Oxford.
- Von Hippel, E., 2005. *Democratizing Innovation*. MIT press.
- Walsham, G., 2006. Doing interpretive research. *European journal of information systems* 15, 320–330.
- Walsham, G., 1995. Interpretive case studies in IS research: nature and method. *European Journal of information systems* 4, 74–81.
- Weber, R.P., 1990. *Basic content analysis*. Sage.
- Weston, C., Gandell, T., Beauchamp, J., McAlpine, L., Wiseman, C., Beauchamp, C., 2001. Analyzing interview data: The development and evolution of a coding system. *Qualitative Sociology* 24, 381–400.
- Wickson, F., Carew, A.L., Russell, A.W., 2006. Transdisciplinary research: characteristics, quandaries and quality. *Futures* 38, 1046–1059. doi:10.1016/j.futures.2006.02.011
- Witte, E., 1973. *Organisation für Innovationsentscheidungen: Das Promotoren-Modell*. O. Schwartz.
- Yanow, D., Schwartz-Shea, P., 2013. *Interpretation and method: Empirical research methods and the interpretive turn*. ME Sharpe.
- Yoo, Y., 2010. *Computing in Everyday Life: A Call for Research on Experiential Computing*. *Mis Quarterly* 34, 213–231.
- Yoo, Y., Boland Jr, R.J., Lyytinen, K., Majchrzak, A., 2012. Organizing for innovation in the digitized world. *Organization Science* 23, 1398–1408.
- Yoo, Y., Henfridsson, O., Lyytinen, K., 2010. Research commentary-The new organizing logic of digital innovation: An agenda for information systems research. *Information Systems Research* 21, 724–735.