

Examining Practice, Structural, and Interpretive Dimensions of Technology Assemblages: The Case of Social Technology Use by Knowledge Workers

Mohammad Hossein Jarrahi

University of North Carolina at Chapel Hill
100 Manning Hall, Chapel Hill, NC 27599, USA
jarrahi@unc.edu

ABSTRACT

This paper theorizes on the sociotechnical dynamics and underlying dimensions of technology assemblages that emerge from the use of social technologies in organizations. This theorization reflects more precisely the information ecology around knowledge workers, which is more technologically diversified than suggested by prior studies. To that end, this work differs from the few studies of social technologies and many studies of ICT in organizations by focusing on more than one technology and by considering social technologies as an assemblage. In order to advance current theorizing about technology assemblages, this work draws on data from a study of knowledge workers' use of social technologies for knowledge sharing and presents three complementary analytic lenses: Practice, Structural, and Interpretive. Integrating the three lenses, allows us to holistically capture the disparate dimensions of social technology assemblages enacted by knowledge workers.

Keywords

Technology assemblages, social technologies, social media, knowledge sharing, enterprise, social informatics

INTRODUCTION

Social technologies are a form of ICT (Information and Communication Technology) that manifest as viable platforms upon which social interactions among individuals can build. This definition of social technologies refer to tools that build on and facilitate social, interpersonal relationships, and are therefore useful for bolstering informal knowledge sharing across temporal and spatial boundaries. This formulation includes both common applications (such as email, phone, and instant messenger) and more recent social networking platforms, often known as social media or Web 2.0, such as blogs, wikis, public social networking sites (i.e., Facebook, Twitter, and LinkedIn), as well as enterprise social networking

technologies that are specifically hosted within one organization's computing environment (i.e., Socialtext).

By studying the uses of single technologies, most studies of social technologies offer modest insights into uses of various social technologies, and the ways in which these technologies serve as conduits for different types of informal knowledge. Further research is therefore needed to examine affordances of social technologies when used in combination. This work must also embrace both traditional and newer forms of social technologies as the use of both types are now pervasive among knowledge workers. The current focus on uses of a single social media confounds our understanding of social technology uses in organizations, and may not sufficiently capture the complexities of combining social technologies. It is only through holistic approaches that we can gain deeper understandings of these technologies and their affordances for work practices.

More broadly, a vast majority of studies of technologies in the workplace traditionally center on the uses of select technologies. For example, Information systems and CSCW (computer-supported cooperative work) researchers have typically studied people's relationships with a freestanding ICT (e.g., Boudreau & Robey, 2005; Orlikowski, 2000; Palen & Grudin, 2003). This focus, however, is not representative of most organizational contexts today because with the influx of new technologies, organizational members have endless choices of technologies and increasingly interact with multiple technologies simultaneously (Kane & Alavi, 2008; Turner, Qvarfordt, Biehl, Golovchinsky, & Back, 2010).

This paper focuses on the more salient and most common technological options that currently facilitate social interactions of knowledge workers (Bughin, Byers, & Chui, 2011), recognizing the fact that knowledge workers now interact with multiple social technologies (as part of an even larger technology assemblage being used), and the interactions among workers and their social tools cannot be examined in isolation (Bélanger & Watson-Manheim, 2006; Turner et al., 2010).

Drawing on a study of knowledge workers' use of multiple social technologies, this paper theorizes on the sociotechnical dynamics of technology assemblages, and presents three complementary analyses that collectively capture three dimensions of social technology assemblage: Practice, Structural and Interpretive.

RELATED WORK

Disparate streams of literature within social computing research have examined the nature and implications of social technologies, delving into the meaning of their uses in various contexts of use. In particular, scholarship concerning social networking technologies or social media emerges from diverse disciplinary and methodological traditions, addresses a range of topics, and builds on a large body of research. Because of their disciplinary focus, these studies mostly examine technology within social contexts other than organizations (boyd & Ellison, 2008).

This body of research provides interesting insights into different aspects of social networking and knowledge sharing in diverse contexts of use. However, the role of organizational boundaries and organizational control is backgrounded in most of these studies. They are typically agnostic regarding the impact of social and organizational structures as most contexts of studies are non-organizational. They lack a focus on structural and institutional influences that may shape workers' interactions around social technologies. Therefore, although findings from this stream of research helps us to understand uses of these technologies, transferring these findings to organizational contexts requires further elaborations (Khan, 2012; A. Richter & Riemer, 2009).

Another body of research offers insight into distinct affordances of social media in organizations. It suggests that the use of social media – as opposed to that of email, phone and IM (instant messaging) systems – enable workers to make their behaviors, knowledge, and preferences visible to others in the organization. Making nuanced aspects of tasks, routines, and know-how visible to a larger number of social contacts creates unique consequences for knowledge sharing (Treem & Leonardi, 2012).

Given the problems of knowledge sharing in many organizations, social technologies in general and social media in particular are seen as viable means for overcoming knowledge boundaries, and facilitating knowledge flow. Even though knowledge sharing and collaboration across boundaries are important aspects of today's knowledge intensive organizations, there is little empirical research on the use of social tools for sharing knowledge (D. Richter, Riemer, & vom Brocke, 2011).

With few exceptions (Archambault & Grudin, 2012; Turner et al., 2010), the overwhelming majority of research on emerging social media in organizations has focused on the use of a single type of social media. In fact, very few studies have taken a broad view of the technological

landscape since the introduction of social media. This body of research offers insight into the affordances of specific social technologies for knowledge sharing in organizations, but does not specifically seek to understand these affordances when social tools are used in combination and as part of a larger assemblage (Jarrahi & Sawyer, 2013; Turner et al., 2010).

The sociotechnical research makes it clear that technology assemblages are beyond a mere composition of multiplicity of technological artifacts (Kling, McKim, & King, 2003). For example what distinguishes social media from earlier ICT is not the technologies themselves but the sociotechnical dynamics around their use (Ellison, Steinfield, & Lampe, 2011). From this perspective, the concept of technology assemblages highlights the way ICT are brought together and used for supporting work practices (Sawyer, Crowston, & Wigand, 2013). Therefore to understand the configuration of technology assemblages, we need to examine the role and diversity of technological artifacts as well as the dynamics of sociotechnical orders emerging from the availability and use of a variety of these technologies.

METHODS

A field-based study was used to advance the examination of the way workers from consulting firms enact technology assemblages using a diversity of social technologies for knowledge sharing. Consultants enjoy a higher degree of liberty to choose the applications and technologies that facilitate their work and knowledge-sharing practices; therefore, their organizational context provides fruitful grounds for studying how multiple social technologies are put into use. Furthermore, based on guidance from literature, these archetypal knowledge-intensive environments are excellent places to study knowledge sharing (e.g., Anand, Gardner, & Morris, 2007), and the role of social technologies is more pronounced.

This work combined four forms of data collection: interviews, micro-studies of practice, documents, and system level data, though the primary source of data for this research is interviews with 58 consultants (informants) from multiple management consulting firms. Informants were identified through purposive sampling of possible contacts. To provide some basis for comparison, informants were selected based on the similarity of their work context, the comparability of the work roles they performed and their ability and willingness to provide key information.

All informants held knowledge-intensive roles and the sampling approach reflects the intent to pursue maximum variation across age, gender, level in the organization (managers vs. non-managers), and adoption behaviors (adopter and non-adopter of social media). This approach allowed for the creation of a diverse group of knowledge workers based on the dimensions that early interviews suggested might influence the use of technologies.

A four part interview protocol was developed that included questions about: (1) informants' professional background, (2) the nature and structure of work, (3) the roles of different ICT including social technologies in knowledge practices, and (4) the organizational context, norms and policies that define informant's work practices. Interviews took 43 minutes on average. All interviews were transcribed.

Also conducted were five micro-studies of practice to better understand daily practices of consultants and their uses of social technologies. To do this, five participants were shadowed. Multiple hours were spent observing them doing their work. These micro-study individuals were identified based on their willingness to participate and their knowledge-intensive work as management consultants. Observations focused on worker's knowledge sharing activities and their uses of social technologies in their work. These micro-studies generated a wealth of field notes.

To supplement the interview data and micro-studies, a variety of personal and organizational documents were analyzed. During interviews, participants were asked to identify relevant documents such as the organization's social media policy or appraisal documentations (e.g., annual performance review documents). The most relevant types of policies for this research were general "code of business ethics", "email policies" and both "internal and external social media policies."

With their permission, informants were followed on LinkedIn and to a lesser degree on Twitter. This system level analysis allowed the observation of the way informants employed Twitter and LinkedIn in their knowledge practices. In particular, the user's postings and activities on these websites were analyzed. Both document analysis and system level data allowed a demarcation of consultants' interpretation of organizational norms.

As is recommended for qualitative research, data collection and analysis proceeded concurrently (Miles & Huberman, 1994). The analysis involved numerous iterations between data collection and construction of an emerging theory. Data analysis was inductive as what was being sought were emergent ideas, leads, and issues (Glaser, 1978). This iterative process enabled the generation of an emerging theory about different dimensions of technology assemblages formed around the use of social technologies in the work of knowledge workers.

FINDINGS

The inductive examination of data gave rise to three analyses that appear to advance three integrative insights about social technology assemblages:

1. Sociomaterial practice: The uses of multiple social technologies are entwined with certain knowledge practices in technology assemblages. This insight is partly rooted in recent postulations that work practices

are intrinsically *sociomaterial* since they are conjoined with the technologies in use. That is, the material (the roles played by technology) and human agency (what humans can achieve) arise and are mutually and emergently productive of one another (Orlikowski & Scott, 2008).

2. Structural: Organizational norms, policies, and expectations as a set of social structures shape the way technology assemblages are constructed.
3. Interpretive: Worker's interpretive frames mediate the way multiple social technologies are used and technology assemblages are further enacted. Interpretive frames consist of assumptions and knowledge of various technologies that help different groups of knowledge workers make sense of them.

These three dimensions collectively illuminate the sociotechnical nature and structure of social technology assemblages in organizations. In this way, we go beyond viewing technology assemblages as a collection of ICT by directing our attention to interdependencies among structural properties of organizations, sociomaterial practices and interpretive frames (See Figure 1). The dimensions are outcomes of three interdependent analyses centering on the interdependencies among the use of multiplicity of social technologies, knowledge practices (as sociomaterial practices), social structures, and interpretive frames.

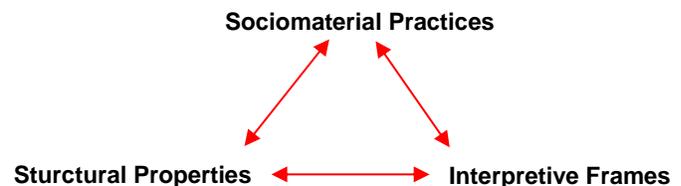


Figure 1. The relationships among the three dimensions of a technology assemblage

In what follows the three complementary analytic lenses are described with a discussion of how an exclusive focus on one aspect of social technology assemblages provides a less robust representation. While focus on each aspect is useful, viewing the three as interdependent and parts of a whole, affords a richer theory of technology assemblages.

Practice-centric Analysis

This practice-centric analysis focuses on the theorization of the role of social technologies (social media and traditional social technologies such as email, phone and instant messengers) in knowledge sharing *practices* in organizational contexts. The analysis draws on the theoretical premise that virtually all work practices performed in organizations are materially enabled and bound up with the use of particular technologies (Orlikowski & Scott, 2008).

The data highlights five sociomaterial knowledge practices which enable knowledge sharing: Expertise locating,

expert locating, reaching out, instrumental socializing, and horizon broadening. Each practice was identified based on an underlying knowledge problem that leads knowledge workers to seek out advice or inputs. Expertise locating involves finding a codified piece of information which is easily searchable in databases or repositories. Expert locating involves finding a person with relevant expertise regarding non-codified pieces of knowledge. The knowledge problems which motivate reaching-out practices overlap with those involved in expert locating. However, in this situation, the knowledge worker's immediate social contacts (strong ties) possess the required knowledge. Based on previous interactions, this practice reflects a level of social awareness about the members in their social network. Knowledge workers get to know their contacts through previous projects and may stay in touch with them beyond a project.

Instrumental socializing and horizon broadening are not driven by immediate work problems. Instead, these practices reflect personal desires to extend one's social networks and learn about other individuals and topics beyond the immediate demands of the work-at-hand (e.g., broader business and technology trends). Each of these sociomaterial practices results in disparate types of knowing, and is mediated by the use of diverse sets of social technologies.

This analysis further outlines the affordances of each social technology based on its role in enabling different knowledge practices. Table 1 outlines how the use of multiple social technologies is integrated in different forms of knowledge practices.

Knowledge practice	Knowledge Objectives	Technologies commonly used
Expertise locating	Finding a relevant piece of information, often easily searchable in databases or repositories	<ul style="list-style-type: none"> • Knowledge repositories • Wikis
Expert-locating	Finding a person with relevant expertise	<ul style="list-style-type: none"> • Email • Forums • Yammer • Twitter • LinkedIn • Corporate portals or internal social networking platforms
Reaching out	Finding the answer to a knowledge problem that is difficult to articulate and search for in databases	<ul style="list-style-type: none"> • Phone • Email • Instant messenger • Twitter

Socializing	Generating, learning about, and maintaining social ties	<ul style="list-style-type: none"> • Blogs • Facebook • Twitter • LinkedIn
--------------------	---------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------

Table 1. Five common knowledge practices mediated by social technologies.

By examining the uses of social technologies in combination, a practice-centric analysis illuminates how they are related in practice. I call the relationships among these technologies the “*relational affordances*” of social technologies. Two significant dimensions of these relational affordances are competition and interoperability. Social technologies compete with one another for relevance as organizational members continually evaluate their functional capabilities and assess their effectiveness in supporting interactions. This suggests that new social technologies introduced into an existing technology assemblage must compete with existing social technologies for supporting work practices. A focus on the concept of relational affordance allows researchers to examine particularly how a new form of technology may or may not be integrated into existing technology assemblages.

In addition, while various social technologies are often articulated as independent and discrete technologies, the interoperability of these tools in day-to-day practices makes such distinctions less meaningful. In the face of certain knowledge problems, workers may take advantage of the differing capacities of various social technologies. These combinatory uses could be concurrent or sequential, meaning that knowledge workers can pair technologies simultaneously or sequentially. A common example of concurrent pairing is using IM to share screens while the two people are on the phone at the same time discussing the document. Here the use of the phone in this reaching out practice is not sufficient; therefore, it is paired with the use of the instant messenger to effectively support the entire practice. It was found that informants often drew upon different social tools sequentially to conduct their communication and knowledge practices. For example, they found contact names on enterprise social networking platforms or on LinkedIn, but contacted them via email. The use of the first social technology allowed them to locate new individuals in the organization or elsewhere, while email provided a private, dyadic channel to convey a specific message or request.

A focus on sociomaterial practices is useful for understanding the centrality of workers' actions to organizational outcomes and the mediating role of social technologies in these actions (Feldman & Orlikowski, 2011). This analysis also reveals that the ways social technologies constitute the technology assemblage are not given *a priori*, but emerge through social practices. In this regard, each social technology may be more useful for particular forms of knowledge practices. For example, social media are typically more useful for horizon

broadening and socializing knowledge practices. In contrast, close examination of instances of knowledge problems in which knowledge workers reach out to their coworkers for an immediate solution shows that email, the telephone or IM are more commonly used, rather than other social technologies

A sole focus on practices and the role of technologies may, however, mask the influence of structural features of organizations, and how technology-mediated practices may be conducted differently by different groups of knowledge workers because of contrasting interpretive frames. Practice-centric studies of technology often involve a micro level analysis (e.g., Stahl & Hesse, 2006). On the other hand, factors such as norms, rules, regulations and institutions that appear to limit or influence the employees' actions, are often best identified through analysis of their structural elements (Orlikowski, 2000). By integrating analysis of social practices with identification of existing social structures, a more nuanced and complete picture of social technology assemblages in organizations begins to emerge.

As an example, prior research suggests social media offer greater visibility that results in more efficient information seeking (boyd, 2010), and that social media in these cases are rated uniformly high on their ability to foster visibility (Treem & Leonardi, 2012). Findings from this study, however, suggest common requirements of confidentiality are one of the primary factors governing knowledge practices in consulting firms. Most informants tended to withhold identifiable information about certain projects or clients from both organizational members and colleagues in other organizations. This made information visibility on enterprise social networking technologies, or cross-boundary knowledge sharing on public social media, much less likely. To this end, the visibility the use of social media affords is largely mediated by structural influences deriving from organizations' policies.

Analysis of sociomaterial practices and technology assemblages can also benefit from an understanding of the role of interpretive frames and different interpretations among knowledge workers. For example, in articulating the relationship between social media and weak ties (those people we interact with less often), McAfee asserts: "The ideal network for a knowledge worker probably consists of a core of strong ties and a large periphery of weak ones... social networking software like Facebook is a powerful tool for connecting weakly tied collaborators and facilitating their interactions" (McAfee, 2009, p. 83-97). By contrast, an examination of the practices knowledge workers conduct for tax and audit functions in consulting firms, reveals that most of their work involves global knowledge. This type of knowledge is easily codifiable and can be easily accessed using databases and knowledge repositories. Therefore, the role of weak ties and social media in the practices of these individuals is less pronounced.

Likewise, McAfee's argument seems to over generalize when it comes to the work practices of many junior knowledge workers in consulting firms, where the work of short-tenured knowledge workers largely involves data collection and analysis. In most knowledge situations examined during this study, junior knowledge workers tended to reach out to strong ties within their work teams (mostly managers) using social technologies such as email, phone or IM. This allowed them to receive support from strongly tied colleagues, as opposed to seeking weak ties in their social media spheres. Therefore, specific work requirements of tax and audit consultants, as well as junior knowledge workers, downplay the role of public social media, or enterprise social networking technologies, in their assemblage of social technologies.

The work presented in this study indicates that a focus on sociomaterial practices needs to be complemented with examinations of the structural influences and the mediating role of workers' interpretive frames.

Structural Analysis

This analysis seeks to identify the effects of specific organizational norms, arrangements and policies on the knowledge sharing practices and respective uses of social technologies that support those practices.

Prior research suggests that affordances of a technology are different when it is used in the organization rather than outside of it (Wellman et al., 1996). This analysis explains some of these differences by focusing on structural properties of consulting firms. It frames structural influences on the use of multiple social technologies in terms of the concept of social structures. The findings highlight the powerful shaping effects provided by common social structures on sociomaterial practices.

In organizations, social structures stem from two distinct sources. First, they can be a direct result of the organization's structures, norms, formal policies: things formally articulated by organizations. Each organization consciously designs these structures to anticipate and guide interactions and activities of its employees. Second, social structures may also gradually arise from ongoing processes of negotiation and social interaction among the members of that organization (Barley, 1990). These forms of social structure can be correlative with articulated formal policies, but are primarily rooted in a common understanding of what organizational work requires and how it is accomplished.

This analysis identifies the seven most salient social structures which include specific organizational arrangements, formal policies and informal norms in consulting firms (shown in Table 2).

Social structures
Matrix organization
Client centricity and distributed collaboration
Technological context (i.e., flexibility, mobility and email dominance)
Norms of collaboration and sharing
Social networking culture
Bounded knowledge sharing
Segregation between personal and professional lives

Table 2. Salient social structures influencing knowledge sharing and uses of social technologies in consulting firms

These social structures described above influence both how consultants do their work and how different social technologies are used for conducting those practices. For example, consultants are required to exercise a very high level of caution in sharing client-related information due to strong protections on corporate intelligence.. Informants almost unanimously concede that sharing even the most unimportant piece of information about their clients may have serious repercussions. For example, merger consultants using geotagging on public social media websites (e.g., Foursquare), may reveal very important information about clients who may be involved in the merger. It is now much easier to draw conclusions from the information posted on people’s multiple profiles on different social media sites. Information shared on Facebook or Foursquare can be easily linked to knowledge workers’ public profiles on LinkedIn, uncovering key information about professional affiliations and activities.

The social structures represented in Table 2 can influence the way social technologies are used in combination and form a technology assemblage. These structures specifically push employees toward distinct enactments of social technologies in use. For example, despite the influx of various forms of social technologies in consulting firms, email is still considered the most effective digital means of organizational communication. This, in part, derives from the influence of organizational policies that may privilege the use of email over other social communication platforms.

A focus on structural properties allows technology researchers to investigate how the presence of explicit and implicit social structures impact organizational members’ activities and engagements with technologies (Avgerou, 2000). A system of shared beliefs and orientations constitute the context within which social technologies are used, regulating knowledge practice and shaping assemblages of social technologies. The combination of social structures in organizations may explain both why and how assemblage of social technologies enacted by

knowledge workers, may be unique and different from other social contexts.

This noted, examinations of more macro social structures should be complemented with an understanding of how micro interactions of social actors unfold and interact with macro structures. Micro practices of knowledge workers can either change social structures or be a departure from prescribed norms. Furthermore, structures do not fully determine user actions; people always have the option, at any moment and within existing social structures, “to do otherwise” (Giddens, 1984, p.14).

Many organizations are now articulating policies and rules to take advantage of social technologies to improve their business. But in doing so, many may ignore the importance of their employees’ improvisational and emerging technological practices. An interesting example to highlight this point is the case of a French technology firm that recently implemented a “zero-email” policy, forcing all 74,000 employees to communicate with each other via an IM and a Facebook-style internal social networking tool (Kim, 2011). The use of similar top-down strategies may be at odds with the daily email practices knowledge workers utilize to reach out to most of their colleagues.

Even though it may seem revolutionary, such organizational approaches tend to overemphasize structural influences. This empirical investigation of knowledge practices, along with several other studies (e.g., Haythomthwaite & Wellman, 1998; Whittaker, Bellotti, & Moody, 2005), suggests email is still a very dominant component of social technology assemblages around knowledge workers. Thus, before designing such policies, it is important for organizations to first understand who in the organization is currently using social technologies, and how they are using them in their knowledge practices (Burnham, 2011).

An exclusive focus on social structure usually confounds the ways in which the interpretive frames of different clusters of knowledge workers come into play. Evidence shows many organizations still impose strict policies, and restrict access to public social networking sites such as Facebook and Twitter (Kaplan, 2012). By putting these formal policies in place, organizations ignore differing interpretations and uses of social technologies among knowledge workers. This study, in line with other studies (e.g., Archambault & Grudin, 2012), finds that many knowledge workers, independent of structural influences and organizational policies, continue to log on to these websites through their mobile devices at work because they may have a personal interest in these technologies. As such, restrictive policies tend to suppress personal preferences while not necessarily stopping workers from using these technologies at work. So, this work highlights the importance of both micro sociomaterial practices and workers’ interpretive frames in understanding the effect of social structures on assemblages of social technologies.

Interpretive Analysis

This analysis is motivated by the need to understand how individual differences among knowledge workers shape their attitudes and the assemblages of social technologies they enact in their practices. In doing so, the analysis reveals how individual differences based on personality traits, knowledge needs of their work, age, and organizational roles may lead to dissimilar interpretations and uses of social technologies.

To delineate individual differences among knowledge workers along these dimensions, we focus on different groups who share similar interpretation of social technologies and are therefore distinct from others. Each group builds from a distinct *interpretive frame* which embodies certain assumptions, exceptions and knowledge of technologies. These interpretive frames enable knowledge workers to make sense of social technologies, shaping workers' subsequent interactions with them. The social groups were identified based on their shared or diverging interpretations of the social technologies.

For example, it was found that workers with managerial roles and their colleagues with non-managerial roles often demonstrate different interpretation and use of social technologies due to variations in the way they organize their work and share knowledge. Almost all of the informants with managerial positions used basic social technologies (email, phone, or IM) extensively and considered them adequate for most knowledge practices. The combination of these technologies allowed them to be constantly reachable, and to serve as reference points within and across the organization.

In contrast to managers, junior knowledge workers had a smaller social network to support their work practices. Junior knowledge workers were still in the process of developing their networks. Through this process, they obtained more understanding of other workers and learned how to leverage their relationships to address knowledge problems. By comparing practices of junior and senior informants, it was concluded that more junior knowledge workers had the need to locate experts in the organizations more frequently than did more senior peers, as managers were likely to be more aware of where expertise could be found in the organization. Because of this need, junior knowledge workers found enterprise social networking platforms more useful for familiarizing themselves with the organizations and its members.

Such examples demonstrate that different groups of knowledge workers enact specific forms of technology assemblages on the basis of their distinct interpretive frames. As such, social technology assemblages are partly shaped by workers' distinctive interpretive schemes, encompassing skills, power, knowledge, assumptions, and expectations about social technologies and their use for their work practices.

However, examinations of the impacts of interpretive differences are best achieved when complemented with a focus on both social structures and work practices. As noted above, a distinct suite of technologies normally supports each knowledge practice. Independent of the interpretive frames knowledge workers hold, the nature of practices affects the choice and use of multiple social technologies. That is, fundamental differences among knowledge practices of expert locating, expertise locating, reaching-out, instrumental socializing and horizon broadening exist, and, these differences may lead to distinct uses of social technologies for each practice.

For instance, prior literature contends that Millennials are the most likely of all age groups to reach out to their peers using social media (e.g., Judd & Kennedy, 2010). This study suggests otherwise; such broad insights regarding the interpretive frames of Millennials, must be supplemented with an examination of work practices. Findings from this work complement this insight by clearly articulating that an overwhelming majority of knowledge workers (no matter their age) primarily drew on email, phone and IM to "reach out" to their strong ties for help with knowledge problems at hand regardless of age. The nature of the knowledge practice of "reaching out" in organization was primarily entangled with the use of these three particular social technologies rather than that of social media in general. This demonstrates the centrality of email, IM and telephone uses in the social technology assemblage of consultants.

A focus on interpretive variations among knowledge workers must also be complemented by an understanding of structural dimensions of technology use. For instance, several studies underscore the inseparability of personal and professional life among younger knowledge workers (e.g., Barzilai-Nahon & Mason, 2010), mainly because Millennials are conceived to be most comfortable with this meshing of work and social life (Winograd & Hais, 2011). Such research argues that due to their interpretive frames, Millennials tend to view the two spheres inseparable, and in particular, when the use of social media is concerned.

Nevertheless, this study suggests that prevailing norms that promote segregation of work and personal life in consulting firms influenced Millennials, and in these contexts, they tended not to be distinct from the rest of knowledge workers in using social technologies. This social norm is currently reinforced by most consulting firms. Social media policies encourage workers to reveal as little information as possible about work and to separate between their personal and professional personas. In line with these policies, the common perceptions and recurrent practices of the young informants interviewed for this research adhered to the separation of personal and professional lives in knowledge sharing practices and their respective uses of technologies.

DISCUSSION

This work supplements the extant social informatics literature (e.g., Sanfillippo & Fichman, 2014) by

advancing the complementarity of the three interdependent analytic lenses in theorizing social technology assemblages. These assemblages are comprised of workers' interpretive frames (as cognitive frames of reference that individuals have about social technologies and their utility), social structures (as an array of social norms and rules as well as structures emerging from social technology uses), and recurrent sociomaterial practices.

The primary theoretical contribution of this work is a conceptualization that captures the three elements shaping technology assemblages by highlighting:

- 1. Multiple technologies:** Technology assemblages are formed around the uses of a *number* of social technology artifacts. As noted, work practices are increasingly supported by the use of various social technologies as the number of social technologies available to workers constantly increases (Watson-Manheim & Bélanger, 2007). Each technology provides a distinct set of affordances that enable work practices differently.
- 2. The mutual constitution of social technology uses and knowledge practices:** Assemblages of social technologies are produced, reinforced and transformed in daily practices and what binds different social technologies together in technology assemblages are work practices, for which multiple social technologies are employed. In the formation of technology assemblages, what matters is the use of social technologies to support work practices; therefore, the material properties of social technologies (as distinctive technological features) themselves do not generate organizational and individual outcomes. The material properties of social technologies are only important when knowledge workers employ them in their work practices. Affordances of each tool are relational to specific practices, and to that of other social technologies.
- 3. Context-specificity and the common shaping pressures of institutional and structural properties:** Social technology assemblages emerging from the use of a group of social technologies in one context may be distinct from those emerging from the use of the same social technologies in other contexts. In other words, the structures and constituents of technology assemblages are contingent upon the context within which social technologies are used. Therefore, work practices and social technology uses are driven by common-to-many context forces such as institutional and structural properties. The research presented here captures the institutional and structural influences by foregrounding the social structures of consulting firms (See Table 2). These structural influences represent contextual particularities, addressing why, among different contexts, the use of the same social

technologies will result in disparate assemblages of social technologies.

- 4. The fact that uses and values of social technology assemblages are not predefined, they are a function of worker's interpretations:** Technology assemblages around different workers in the same context are not entirely identical and may vary based on how they make sense of the social technologies available to them. Findings from this work posit that individuals are knowledgeable about choices and have agency to shape the way technologies work based on their knowledge, assumption, and expectations. This recognizes the agentic capacity of their actions. While social structures enable and constrain workers' actions, "humans are relatively free to enact technologies in multiple ways" (Boudreau & Robey, 2005, p. 3-4). In other words, social structures do not entirely determine the formation of potential technology assemblages. Examinations of interpretive frames related to different groups of knowledge workers suggest that divergent enactments of social technology assemblages with the same organizational contexts are partly rooted in different interpretive frames.

This study generates implications for practice, as many organizations are now grappling with the use of social technologies (Archambault & Grudin, 2012). Addressing the above concerns, findings from this work suggest that for designing and managing social technologies, we must focus on how the three elements of assemblages of social technologies (practice, structural, and interpretive) can be accommodated and managed in an attempt to encourage more effective uses of social technologies in various organizational circumstances.

The notion of technology assemblages can be useful for vendors and designers of social technologies as well as organizations employing these tools. A key aspect of the technology assemblage is the competition among tools. The discussion presented in this paper makes it clear the use of a social technology does not find its way to the technology assemblage, enacted in practice, unless it offers distinct advantages over alternatives. The value of each technology for knowledge sharing is meaningful only in relation to other available options.

Consistent with the notion of technology assemblages, findings further imply that the diversity of social technologies is a defining element of the information space around most knowledge workers. This diversity allows knowledge workers to improvise and appropriate multiple social technologies for various work practices. Approaches aimed at unification of social technologies, that is, the incorporation of tools into a single whole with tight interdependencies, seems to be shortsighted. Providing a single social platform may diminish the possibility of enacting diverse combinations of social technologies in practice to meet wide-ranging sets of work requirements.

Rather than focusing on unification of social technologies, approaches that promote diversification and integration of social tools are more likely to be consistent with the reality of knowledge work. Integration endorses the use of a multiplicity of social tools by encouraging interoperability among them. The interoperability among social technologies is also required for integration. With greater interoperability among social tools, knowledge workers see their information and technological environment as less fragmented. A good example is the integration of IM and email systems in many organizations in this study. The two systems are seamlessly integrated, but employees are still able to use these tools alone.

CONCLUSION

In an overall examination of technology assemblages in organizations, the line of reasoning presented in this paper indicates that examinations of work practices, interpretive frames and structural properties of organizations are both valuable and complementary. In effect, all of these interdependent dimensions collectively form social technologies assemblages, and these assemblages take place at the confluence of their impacts.

Taken together, findings from this research provide the basis to theorize on technology assemblages as collections of social technologies and identifiable work practices which they support. This theorizing also illustrates the ways that social technology assemblages are subject to institutional and structural influences as well as personal preferences. That is, social technology assemblages are not infinitely diverse (because of institutional and structural influences) but, yet, are quite flexible (due to attitudinal and other describable differences among knowledge workers which lead to differential forms of use).

Due to the idiosyncratic nature of each context, the results of the theorization of social technology assemblages may be geared towards the particularities of the context of study. For example, instances of social structures, knowledge practices, social technology uses, and interpretive frames when discussed in this study, may not be fully generalized in regards to other organizational and social contexts. However, the three dimensions and their interdependencies tend to accommodate different aspects of uses of multiple technologies in other contexts. This theorization can therefore be applied in other organizational contexts and refined based on future research.

REFERENCES

- Anand, N., Gardner, H. K., & Morris, T. (2007). Knowledge-based innovation: emergence and embedding of new practice areas in management consulting firms. *The Academy of Management Journal* 50(2), 406-428.
- Archambault, A., & Grudin, J. (2012). *A Longitudinal Study of Facebook, LinkedIn, & Twitter Use*. Paper presented at the CHI 2012, Austin, TX.
- Avgerou, C. (2000). IT and organizational change: an institutionalist perspective. *Information Technology & People*, 13(4), 234-262.
- Barley, S. (1990). Images of imaging: Notes on doing longitudinal field work. *Organization Science*, 1(3), 220-247.
- Barzilai-Nahon, K., & Mason, R. (2010). How Executives Perceive the Net Generation. *Information, Communication and Society*, 13(3), 396-418.
- Bélanger, F., & Watson-Manheim, M. B. (2006). Virtual teams and multiple media: Structuring media use to attain strategic goals. *Group Decision and Negotiation*, 15(4), 299-321.
- Boudreau, M. C., & Robey, D. (2005). Enacting integrated information technology: A human agency perspective. *Organization Science*, 16(1), 3-18.
- boyd, d. (2010). Social network sites as networked publics: Affordances, dynamics, and implications. In Z. Papacharissi (Ed.), *A networked self: Identity, community, and culture on social network sites* (pp. 39-58). New York: Routledge.
- boyd, d., & Ellison, N. (2008). Social network sites: Definition, history, and scholarship. *Journal of Computer Mediated Communication*, 13(1), 210-230.
- Bughin, J., Byers, A. H., & Chui, M. (2011). How social technologies are extending the organization. *McKinsey Quarterly; November*.
- Burnham, K. (2011). Enterprise Social Software: What Businesses Need to Do Next. *CIO, November 03*.
- Ellison, N. B., Steinfield, C., & Lampe, C. (2011). Connection strategies: Social capital implications of Facebook-enabled communication practices. *New Media & Society*, 13(6), 873-892.
- Feldman, M. S., & Orlikowski, W. J. (2011). Theorizing practice and practicing theory. *Organization Science*, 22(5), 1240-1253.
- Giddens, A. (1984). *The constitution of society: Outline of the theory of structuration*. Cambridge, UK.: Polity Press.
- Glaser, B. (1978). *Theoretical sensitivity: Advances in the methodology of grounded theory*. Mill Valley, CA: Sociology Press.
- Haythomthwaite, C., & Wellman, B. (1998). Work, friendship, and media use for information exchange in a networked organization. *Journal of the American Society for Information Science*, 49(12), 1101-1114.
- Jarrah, M. H., & Sawyer, S. (2013). Social Technologies, Informal Knowledge Practices, and the Enterprise. *Journal of Organizational Computing and Electronic Commerce*, 23(1-2), 110-137. doi: 10.1080/10919392.2013.748613
- Judd, T., & Kennedy, G. (2010). A five-year study of on-campus Internet use by undergraduate biomedical students. *Computers & Education*, 55(4), 1564-1571.
- Kane, G., & Alavi, M. (2008). Casting the net: A multimodal network perspective on user-system interactions. *Information Systems Research*, 19(3), 253-272.
- Kaplan, M. (2012). Banned on Wall St.: Facebook, Twitter and Gmail. Retrieved 13 Jan, 2013, from <http://dealbook.nytimes.com/2012/11/22/banned-on-wall-street-facebook-twitter-and-gmail/>
- Khan, G. F. (2012). Social media-based systems: an emerging area of information systems research and practice. *Scientometrics*, August 1-22.
- Kim, S. (2011). Tech Firm Implements Employee 'Zero Email' Policy. Retrieved 16 Jan, 2013, from <http://news.yahoo.com/tech-firm-implements-employee-zero-email-policy-165311050.html>
- Kling, R., McKim, G., & King, A. (2003). A bit more to it: scholarly communication forums as socio-technical interaction networks. *Journal of the American Society for Information Science and Technology*, 54(1), 47-67.

- McAfee, A. (2009). *Enterprise 2.0, New Collaborative Tools for Your Organization's Toughest Challenges*. Boston, MA: Harvard Business School.
- Miles, M. B., & Huberman, A. M. (1994). *Qualitative Data Analysis, 2nd Edition*. Thousand Oaks, CA: Sage Publications.
- Orlikowski, W. J. (2000). Using technology and constituting structures: A practice lens for studying technology in organizations. *Organization Science*, 11(4), 404-428.
- Orlikowski, W. J., & Scott, S. V. (2008). Sociomateriality: Challenging the Separation of Technology, Work and Organization. *The Academy of Management Annals*, 2(1), 433-474.
- Palen, L., & Grudin, J. (2003). Discretionary adoption of group support software: lessons from calendar applications. In B. E. Munkvold (Ed.), *Implementing Collaboration Technologies in Industry*. Heidelberg: Springer Verlag.
- Richter, A., & Riemer, K. (2009). *Corporate Social Networking Sites—Modes of Use and Appropriation through Co-Evolution*. Paper presented at the 20th Australasian Conference on Information Systems, Melbourne Australia.
- Richter, D., Riemer, K., & vom Brocke, J. (2011). Internet social networking. *Business & Information Systems Engineering*, 3(2), 89-101.
- Sanfillippo, M., & Fichman, P. (2014). The Evolution of Social Informatics Research (1984-2013): Challenges and Opportunities. In P. Fichman & H. Rosenbaum (Eds.), *Social Informatics: Past, Present and Future*. Cambridge, United Kingdom: Cambridge Scholars Publishing.
- Sawyer, S., Crowston, K., & Wigand, R. (2013). Digital assemblages: Evidence and theorizing from the computerization of the U.S. residential real estate industry. *Working paper, Syracuse University, School of Information Studies*.
- Stahl, G., & Hesse, F. (2006). Social practices of computer-supported collaborative learning. *International Journal of Computer-Supported Collaborative Learning*, 1(4), 409-412.
- Treem, J., & Leonardi, P. (2012). Social Media Use in Organizations: Exploring the Affordances of Visibility, Editability, Persistence, and Association. *Communication Yearbook*, 36, 143-189.
- Turner, T., Qvarfordt, P., Biehl, J. T., Golovchinsky, G., & Back, M. (2010). *Exploring the workplace communication ecology*. Paper presented at the CHI '10, Atlanta, GA.
- Watson-Manheim, M. B., & Bélanger, F. (2007). Communication media repertoires: Dealing with the multiplicity of media choices. *MIS quarterly*, 31(2), 267-293.
- Wellman, B., Salaff, J., Dimitrova, D., Garton, L., Gulia, M., & Haythornthwaite, C. (1996). Computer networks as social networks: Collaborative work, telework, and virtual community. *Annual review of sociology*, 213-238.
- Whittaker, S., Bellotti, V., & Moody, P. (2005). Introduction to this special issue on revisiting and reinventing e-mail. *Human-Computer Interaction*, 20(1-2), 1-9.
- Winograd, M., & Hais, M. (2011). *Millennial momentum: How a new generation is remaking America*. Piscataway, NJ: Rutgers University Press.