

Untangling Knowledge Creation and Knowledge Integration in Enterprise Wikis

Abstract: *A central challenge organizations face is how to build, store, and maintain knowledge over time. Enterprise Wikis are community-based knowledge systems situated in an organizational context. These systems have the potential to play an important role in managing knowledge within organizations, but the motivating factors that drive individuals to contribute their knowledge to these systems is not very well understood. We theorize that Enterprise Wiki initiatives require two separate and distinct types of knowledge-sharing behaviors to succeed: knowledge creation (KC) and knowledge integration (KI). We examine a Wiki initiative at a major German bank to untangle the motivating factors behind KC and KI. Our results suggest KC and KI are indeed two distinct behaviors, reconcile inconsistent findings from past studies on the role of motivational factors for knowledge sharing to establish shared electronic knowledge resources in organizations, and identify factors that can be leveraged to tilt behaviors in favor of KC or KI.*

Keywords: knowledge management, knowledge creation, motivation, costs, rewards, knowledge integration, enterprise wiki.

JEL Classification: D83, D85, L86

1 Introduction

Organizational knowledge constitutes a key asset and can be a potential source of competitive advantage (Cabrera and Cabrera 2002). However, merely possessing stored knowledge in one part of an organization or in a given employee does not necessarily mean other parts of the organization or other employees can use and benefit from it. Organizations face a central challenge: how to build, store, and maintain knowledge over time (Gold et al. 2001). To do this, knowledge sharing must be fostered among employees. Unfortunately, however, it is often a challenge for organizations to get employees to share their knowledge (Orlikowski 1993b; Davenport and Prusak 1998).

Web-based technology and the development of corporate intranets have created new opportunities for building electronic knowledge repositories (EKRs) with the potential to facilitate knowledge sharing among employees within an organization. Some companies have embraced wikis as a means of creating a Web-based community of employees who freely share their expertise and, at the same time, create a knowledge repository useful to others. However, the success of corporate wikis hinges on achieving broad-based employee participation. Online communities in a variety of contexts have failed because they could not achieve sustainable participation (Ransbotham and Kane 2011), with estimates suggesting that upwards of 80 percent of enterprise social networks will fail (Gartner 2013). Further, although wikis are emerging as a preferred way of managing knowledge in companies, actual wiki usage remains low because – among other things – managers do not know how to encourage the type of participation that will produce meaningful results (McKinsey 2009; McKinsey 2013).

The word wiki can be traced back to the Hawaiian word for “quick.” It describes a collaborative authoring platform that allows users to create and edit interlinked Web pages using a Web

browser (Wagner 2004; Wagner and Prasarnphanich 2007). Wikis can foster collective intelligence by enabling geographically dispersed individual contributors to pool their knowledge.

Unlike other innovations that can be adopted by a single individual and still be beneficial, wikis must involve a critical mass of users to achieve their network effects (Markus 1987). These users must be willing to share their knowledge to produce significant benefits for an organization (Ransbotham and Kane 2011). As with other knowledge management (KM) initiatives, success requires generating sufficient interest among “knowledge suppliers” to create and sustain the knowledge base and among “knowledge seekers” to access and use the wiki when they need to solve a particular business problem (Phang et al. 2009). We focus here on understanding how organizations can promote interest among knowledge suppliers.

Although there has been research on knowledge sharing in the context of EKR (Kankanhalli et al. 2005; Alavi and Leidner 2001), the motivational factors that drive individuals to contribute their knowledge to enterprise wikis are not very well understood and some conflicting findings have been reported in the literature (see, for example, Wasko and Faraj 2005 and Kankanhalli et al., 2005).

The literature on Free/Libre Open Source Software (FLOSS) also addresses why individuals voluntarily contribute time, effort, and knowledge to projects. In this stream of work, studies have generally classified the motivations to contribute as either intrinsic or extrinsic (Hars and Ou 2002; Lakhani and Wolf 2005; Roberts et al. 2006; Wu et al. 2007). However, the institutional context alters how motivations develop and the role of motivations in affecting individuals’ contribution to projects (von Krogh 2012, p. 653). Thus, it is important to explore whether the factors that motivate individuals to contribute in a FLOSS context also explain why individuals are motivated to share their knowledge in the context of enterprise wikis. After all, as wikis are situ-

ated in an organizational context, they differ from open source systems in two important aspects. First, they require greater participation than FLOSS projects because of the much smaller base of potential participants. While it may be sufficient for a tiny percentage of all Internet users to contribute to Wikipedia or to an open source software project, this does not hold true in an organizational context (McAfee 2009). Second, work organizations arguably have more power over individuals than do loose-knit communities and thus have a broader range of incentives that can be brought to bear to motivate employees to engage in knowledge sharing.

Elaborating on the conceptualization of knowledge sharing used in past work, more recent research has identified different forms of knowledge sharing involved in the successful development of a wiki. For example, Majchrzak et al. (2013) identified two important activities of wiki contributors: “knowledge adding” and “knowledge shaping.” They thereby provide some evidence for the importance of uncovering the different knowledge-sharing activities and motivations.

Informed by the distinction observed by Majchrzak et al. (2013) and by Dixon’s (2000) conceptualizations of creating, connecting, and transferring knowledge, and drawing on the organizational knowledge management literature (e.g., Grant 1996; Spender 1996), we differentiate between two knowledge sharing activities: knowledge creation (KC) and knowledge integration (KI). In the wiki context, we conceptualize KC as creating new pages and adding knowledge to pages created by others, thereby effectively translating personal experiences into explicit knowledge. We conceptualize KI as reorganizing, linking, and synthesizing knowledge contributed by others. KI thus involves rewriting pages created by others to transfer knowledge across different enterprise units (e.g., between IT department and business departments) or across different locations of an enterprise.

We explore the relative importance of various intrinsic and extrinsic motivating factors that affect KC and KI behaviors and develop and test a research model designed to explain these two knowledge-sharing behaviors. Our aim is to shed light on the underlying motivational mechanisms that drive these different knowledge-sharing behaviors within organizations, thereby contributing to theory. In so doing, we respond to Majchrzak's (2009) call for research to generate theoretical insights about wikis by elaborating the conceptualization of associated use behaviors.

This article is organized as follows. Section 2 ("Theoretical Background") reviews the related literature that examines participation in EKR and explains the reasons for extending this stream of research. We also highlight in Section 2 theories that explain different motivational drivers of knowledge sharing. In Section 3 ("Research Model and Hypotheses"), we develop five research hypotheses to test the findings of these theories. Section 4 ("The Empirical Study") describes the data collection and method employed. Section 5 ("Discussion and Implications") highlights our findings and elaborates on the theoretical and managerial implications of those findings. Section 6 notes strengths and limitations and points to paths for future research. Finally, Section 7 summarizes the findings.

2 Theoretical Background

2.1 Wikis: A Distinctive Approach to Community-Based Knowledge Management

Advances in information and communication technologies have created a growing interest in leveraging technology to advance community-based models of knowledge sharing in organizations (Huysman and Wulf 2006; Majchrzak et al. 2013). In theory, such knowledge management

systems can serve as repositories that promote the transfer and reuse of knowledge that would otherwise be held only by individuals (Watson and Hewett 2006).

Community-based EKR's such as discussion forums or threaded conversations follow the model of conversational knowledge creation and use (Wagner and Bolloju 2005; Wagner 2004). They emerged with the availability of social media and helped address several challenges commonly associated with knowledge sharing (Majchrzak et al. 2013), including the bottleneck of sharing expertise (Wagner 2006), the lack of incentive to share knowledge (O'Dell and Grayson 1998), lack of contextuality associated with shared knowledge (Feigenbaum 1992), and the maintenance problem that is exacerbated as knowledge is added over time (Brooks 1995). In the context of community-based EKR's, large numbers of small contributions aggregate to substantial knowledge assets. So, knowledge seekers gain from the contributions of many while these contributions require little effort because the technology is easy to use. In addition, knowledge can be highly contextual and up-to-date due to the expertise of many contributors (Majchrzak et al. 2013).

Despite their success, however, community-based EKR's created new problems such as incomplete answers, redundancy, and poor knowledge integration. Wikis are a new type of community-based EKR with the potential to overcome these problems. While sharing particular properties with community-based EKR's, they have distinctive features. For instance, the knowledge in wikis is topically oriented and can be integrated well by contributors. This reduces inconsistent and repetitive information and lowers the cognitive integration effort required of knowledge seekers. In contrast to time- or thread-based approaches that hamper knowledge integration and contextuality of knowledge, the topic-oriented knowledge structure of wikis promotes higher contextuality and makes knowledge editable (Majchrzak et al. 2013).

2.2 Knowledge Sharing in Community-Based Knowledge Management Systems

Many knowledge management systems have failed because organizations were unwilling or unable to develop an organizational culture that promoted knowledge sharing (Alavi et al. 2006). The absence of such a culture makes it a struggle for organizations to benefit from their investments in knowledge management systems. Nahapiet and Ghoshal (1998) emphasize three pre-conditions for realizing organizational advantage from contributing intellectual property to a social system: the opportunity for knowledge sharing and exchange must be given; knowledge sharers must expect that their participation in exchanging and integrating knowledge will be worthwhile even if the particular outcomes are uncertain; and the contributors must be motivated to contribute.

Motivational factors have been identified as critical for any successful knowledge management system (Wasko and Faraj 2000). The literature on psychological needs and motivation can be further divided into internally and externally driven motivation, as reflected, for instance, in self-determination theory (Ryan and Deci 2000). Intrinsic motivation has been linked closely to inherent human needs for autonomy and competency; extrinsic motivation has been linked to operant conditioning, which explains why incentives can reinforce a desired human behavior (Deci and Ryan 2000). Research suggests intrinsic and extrinsic motivation, as well as the effort required to add and edit content, are the three critical success factors in implementing a knowledge management system (Osterloh and Frey 2000). Recent FLOSS studies elaborate the conceptualization of intrinsic and extrinsic motivation to include a third type of motivation: internalized extrinsic motivation (von Krogh 2012), which is not inherently intrinsic – such as enjoyment from an activity – but represents the internalization of individuals finding an activity to be valuable or meaningful in their social groups (Deci and Ryan 2002).

As with any community-based model of knowledge sharing, getting individuals in an organization to share their knowledge for broader use by others in the organization is a social dilemma (Cabrera and Cabrera 2002): While the organization as a whole stands to benefit if everyone shares their knowledge, individuals may conclude it is not worth their while. In this way, wikis represent an instance of the public goods dilemma (Cabrera and Cabrera 2002) in which the public good is underprovided (relative to the “social optimum”) because individuals lack sufficient motive to contribute. A wiki can be considered as an instance of a public good because it represents a shared resource from which all members of the organization can benefit “regardless of whether or not they personally contribute to its provision, and whose availability does not diminish with use” (Cabrera and Cabrera 2002). Since everyone in the organization has access to the wiki, individuals may be tempted to use it to gain access to knowledge beneficial to them without feeling the need to contribute their own knowledge. This is the so-called “free-rider” problem (Groves and Ledyard 1977; Musgrave 1959). It therefore remains a topic for research to explore why some individuals choose to share knowledge in the context of an enterprise wiki so that other individuals in the organization, or the organization at large, can benefit.

From an economic perspective, individuals choose to participate when the perceived benefits of sharing outweigh the perceived costs. There are many possible benefits of knowledge sharing; these include reputational enhancement, enjoyment in helping others, expectations of reciprocity, organizational rewards, and a sense of identification with a community of similarly motivated individuals (Wasko and Faraj 2005; Kankanhalli et al. 2005). Time and effort are the primary costs associated with knowledge sharing. Cabrera and Cabrera (2002, p. 695) contend that social dilemmas such as the public goods dilemma can best be addressed by “restructuring the pay-off

function.” In enterprise wikis, this would entail increasing the incentives associated with sharing one’s knowledge and reducing the costs as much as possible.

Arazy et al. (2010) focus on the collaborative editing nature of wikis, distinguishing different authorship (or knowledge sharing) categories and acknowledging that in corporate wikis authorship visibility is important to gain benefit from different authorship (e.g., creating or integrating knowledge). However, while they identify that there are different authorships, they do not theorize differences in knowledge-sharing activities or suggest how knowledge-sharing activities are motivated in a corporate context.

2.3 Knowledge Sharing: Differentiating Between Creation and Integration

As individuals increase their specialization in knowledge, their breadth of knowledge decreases because of bounded rationality constraints (Grant 1996). Organizations require a diverse base of knowledge to execute their value-creation activities, and so they are challenged not only to cultivate specialization of knowledge but also promote integration of knowledge. Moreover, as collective knowledge is the “most secure and strategically significant kind of organizational knowledge” (Spender 1996, p. 52), it is important to understand how this collective knowledge can be established through a wiki. Towards this end, we differentiate between KC and KI.

We define KC as the development and codification of new knowledge in the form of new pages and adding knowledge to pages created by others, thereby effectively translating personal experiences possessed by an individual into explicit knowledge (Nonaka 1994). Knowledge creation occurs when individuals add their own specialized knowledge to an EKR, thereby making it available as organizational knowledge that can be used by others. Such knowledge is generally domain-specific and can be applied to particular work-related tasks, but once it is placed in the EKR it tends to become a static, standalone piece of knowledge precisely because those systems

lack the possibility to revise content, add links, or add comments easily. Prior to the development of wiki technology, the typical EKR supported only this type of knowledge sharing and there was no real capability for others within the company to refine or integrate knowledge in the EKR. Wiki technology overcomes these EKR limitations, allowing knowledge creation by translating individual experiences and then transferring that knowledge and connecting it with other knowledge.

While the term knowledge integration (KI) is often used to refer to organizational-level integration of knowledge across different functional units (Kogut and Zander 1992), we are interested in the integration of knowledge in a wiki shared by multiple individuals (i.e., individual-level knowledge integration). With increasing specialization, the efficiency of internal knowledge transfer decreases and thus boundary-spanning individuals are needed to transfer knowledge within enterprises and link together knowledge areas across different communities of practice (Tushman and Scanlan 1981).

An enterprise can be envisioned as a conglomerate of communities of practice (Wenger 1998) in which individuals not only need to share their knowledge with others but also need to connect it and bring it into an integrated schema so it can be leveraged in new ways (Tiwana and McLean 2005). In theory, this type of knowledge integration can be a powerful way to spur innovation and create value by allowing employees to recombine and apply individual nuggets of knowledge in new and interesting ways (Moran and Ghoshal 1999). Knowledge integrators are essential for connecting knowledge-creation efforts across the wiki (von Krogh et al. 1997). Knowledge integration allows links to be drawn between what might otherwise be seen as disparate bodies of knowledge, thereby facilitating subsequent innovation processes. We conceptu-

alize KI as a catalytic activity that includes editing and rewriting previous contributions to a wiki as well as reorganizing and linking knowledge within a wiki.

While KC and KI are both important, they are different behaviors and therefore may involve different underlying motivations. In this study, we explore the factors that drive these two different types of knowledge-sharing behaviors¹. Table 1 summarizes their different characteristics.

Table 1: Distinctions between Knowledge Creation and Knowledge Integration

Definition and Distinguishing Characteristics	Knowledge Creation	Knowledge Integration	Informing sources
Definition	Development and codification of new knowledge through the interplay of existing tacit and explicit knowledge possessed by an individual.	Synthesis of individuals' specialized knowledge so it can be leveraged more readily across individuals and communities of practice within organizations.	(Nonaka 1994); (Alavi and Tiwana 2002)
Operationalization in a wiki context	Sharing one's knowledge by creating new wiki pages or adding significant new content to existing wiki pages.	Contributing to the collective knowledge base by integrating or synthesizing content created by others (includes editing, rewriting, reorganizing, and integrating).	(Majchrzak et al. 2006); (Majchrzak et al. 2013)
Nature of task	Creating new content from individual experiences and codifying it.	Refining and linking content provided by others in a way that can be accessed by other members of the organization.	(Lakhani and von Hippel 2003); (Nonaka 1994); (Tushman and Scanlan 1981)

One distinction that can be drawn between KC and KI concerns the nature of the tasks themselves. The process of knowledge creation can be defined as the formation of new ideas through interactions between tacit and explicit knowledge with codified knowledge as the result (Nonaka 1994). In the wiki context, knowledge creation includes creating new pages as well as adding knowledge (e.g., new ideas, new data, new sections) to existing pages, whereas knowledge inte-

¹ Another way of describing different types of authorship now distinguished by different motivational drivers has been suggested by Anthony et al. (2009), who focused on the quality of contributions to a public wiki system and distinguished between “zealots” and “good Samaritans” who correspond quite similarly to our two types of KC and KI behavior. Zealots are characterized as being strongly interested in gaining reputation, whereas good Samaritans are interested in helping others.

gration includes translating, reorganizing, rewriting, or restructuring existing knowledge. Thus, KC can be regarded as the task of creating new content from individual experiences and codifying it in a form that can be accessed by other members of the organization. KI, in contrast, can be regarded as the (sometimes mundane but) necessary task (Robert et al. 2008; Lakhani and von Hippel 2003) of refining or linking content provided by others.

Another distinction regards time and effort. KC generally requires considerable time and effort because it often requires that one begin with a blank slate. KI, in contrast, involves working with material that already exists and that needs to be connected and linked to other material. This activity can be more or less labor-intensive depending on the content's degree of complexity or the heterogeneity of related material that needs to be connected. In general, however, it can be assumed that KC requires more codification effort and time and consequently is more costly than KI (Alavi and Tiwana 2002; Nonaka 1994). As these distinctions suggest, one challenge with KI is that integrating knowledge into an existing body of knowledge within a wiki can sometimes be complex and laborious (Lakhani and von Hippel 2003).

Moreover, there may be less organizational or team recognition given to those who perform knowledge integration compared to those who perform knowledge creation (Bergeron 2007). Research suggests that organizations do not sufficiently encourage employees to perform KI (Alavi and Tiwana 2002). This is unfortunate, since KI is of essential importance for organizations (Eisenhardt and Martin 2000; Grant 1996). Research (e.g., Faniel and Majchrzak 2007; Levina and Vaast 2005) also points to the importance of establishing common knowledge objects across departments. This can be especially challenging given that people in different professional groups (that is, "domains" within the organization, such as accounting, human resources, information systems, and so on) may employ their own terminology or "jargon," which makes it dif-

difficult for others to interpret, adapt, and use their knowledge in problem solving (Dougherty 1992).

2.4 Summary

Wikis are a distinct form of community-based knowledge management system because they are situated in organizations and not open communities. This contextual characteristic of wikis requires that they have higher levels of knowledge sharing from employees to succeed than that required from individuals for the success of open source community systems (McAfee 2009). Research on what motivates individuals to share knowledge in an organizational context has focused primarily on KC in the context of EKR and FLOSS, has not differentiated between KC and KI in examining the role of various motivation factors, cost, and effort in knowledge sharing, and has not focused much attention on knowledge sharing in the context of enterprise wikis. As a result, we have an incomplete picture of how key motivational factors and considerations of time and effort affect the different types of knowledge sharing—that is, KC and KI—especially in the context of enterprise wikis. Hence, we develop our research model and hypotheses with a focus on advancing understanding in this area.

3 Research Model and Hypotheses

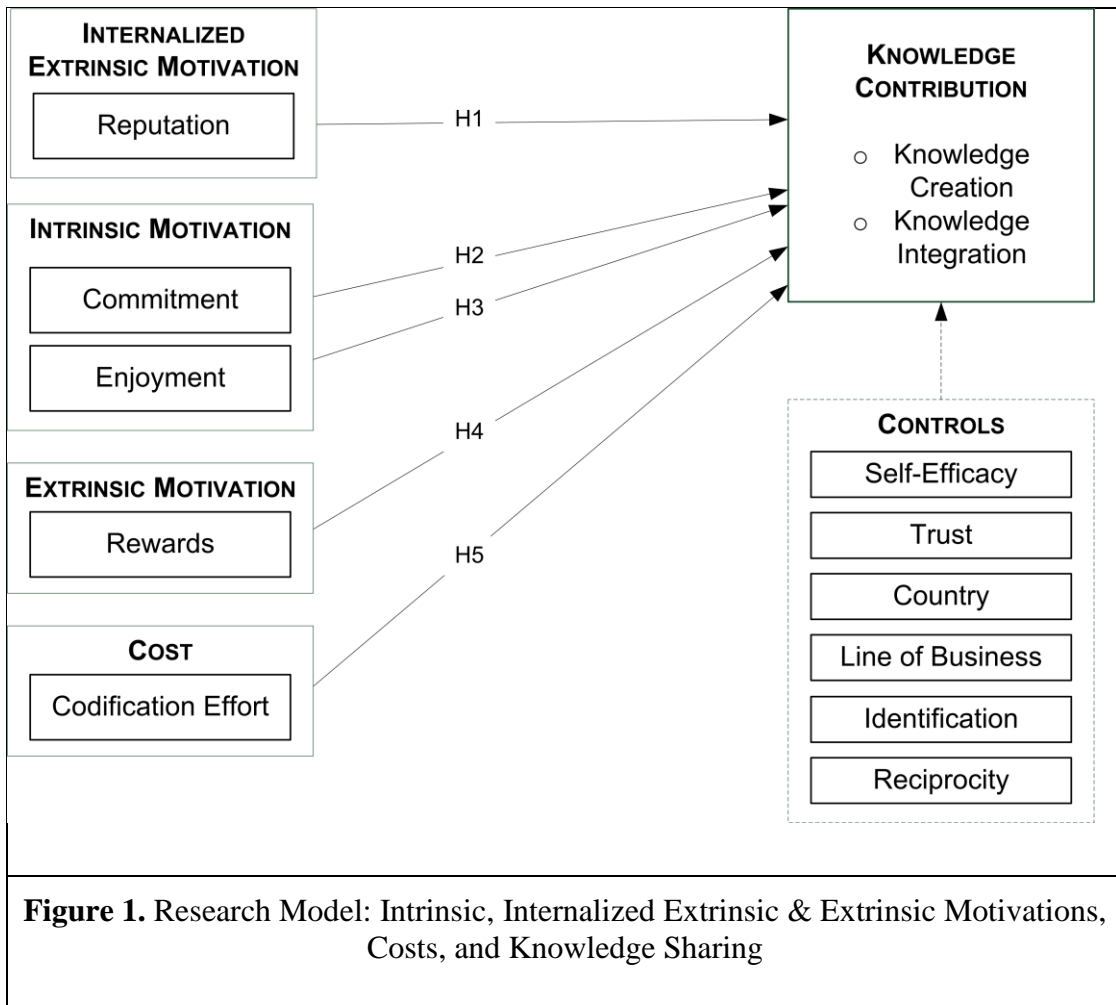
Drawing on the literature on EKR in organizations (specifically Kankanhalli et al. (2005) and Wasko and Faraj (2005)) and on the FLOSS literature, we developed a research model (Figure 1) to elaborate our understanding of knowledge sharing in enterprise wikis. In this section, we first describe the building blocks of the model and how they are derived from the literature, and then derive a set of five corresponding research hypotheses.

3.1 Selection of Motivational and Effort Factors

According to the meta-analyses by von Krogh (2012) and Schilling (2014), the distinction between intrinsic and extrinsic motivation in self-determination theory (SDT) has been the most widely used framework to study motivational factors in a FLOSS context (see Deci and Ryan 1985; Gagné and Deci 2005). Following von Krogh et al. (2012), the motivational factors identified as pertinent to understand contribution behaviors in a FLOSS context can be mapped to *intrinsic motivation*, *internalized extrinsic motivation*, or *extrinsic motivation*. While some motivations are inherently intrinsic or extrinsic, individuals could also internalize what is considered valuable or meaningful in a social group (Deci and Ryan 1987; Deci and Ryan 2002; Roberts et al. 2006). This process of internalizing the perceived value of activities in a social group creates internalized extrinsic motivation that self-regulates an individual's behavior. We adopt this distinction and theorize the influence of three key motivation factors on KC and KI: (1) reputation for internalized extrinsic motivation (Roberts et al. 2006; Lerner and Tirole 2002; Ghosh 2005); (2) enjoyment and commitment for intrinsic motivation (Lakhani and Wolf 2005; Osterloh and Rota 2007; Benkler 2002); and (3) rewards for extrinsic motivation (Lakhani and Wolf 2005; Hars and Ou 2002; Hertel et al. 2003). We add a fourth category of variables to capture costs associated with knowledge sharing; Kankanhalli et al. (2005) have shown that costs can also be an important factor. Specifically, we include codification effort in this category because employees can differ in their assessments of the time and effort required to engage in knowledge sharing through the wiki.

In sum, our model (1) differentiates between KC and KI, (2) includes key factors associated with intrinsic, internalized extrinsic and extrinsic motivation, and (3) considers costs of knowledge sharing. By doing so, we extend past work by theorizing (a) why reputation, commitment, and

enjoyment that have been found to affect knowledge sharing in an EKR context can be expected to influence both KC and KI in a wiki context (H1, H2 and H3), and (b) the differential effects of the extrinsic motivational factors—namely, organizational rewards and codification effort—on KC and KI (H4 and H5).



3.2 Reputation

We theorize how reputation, specifically an individual’s perception of increase in reputation due to sharing knowledge in a wiki (Constant et al. 1996), affects KC and KI. Knowledge creators and knowledge integrators may enhance their reputation or image in an organization by contributing to the community (Ba et al. 2001; Constant et al. 1994; Constant et al. 1996), thereby im-

proving their standing within an organization (Roberts et al. 2006). Peer reputation has been found to be a fundamental motivation for key forms of participation in the FLOSS context as well (Lerner and Tirole 2002; Gosh 2005; Hars and Ou 2002; Hemetsberger 2004; Lakhani and Wolf, 2005). More specifically, Lerner and Tirole (2002) as well as Lattemann and Stieglitz (2005) state that reputation is a motivational factor not only for programmers but also “bug fixers.” In a similar vein, Markus et al. (2000) and Roberts et al. (2006) argue that writing open source software and helping test and debug it are critical ways to earn respect in FLOSS communities. Lakhani and von Hippel (2003) found that both the “core or major task activities” and the “mundane but necessary” activities of FLOSS projects are similarly motivated.

All the references cited above agree that reputation is a motivational factor for different kinds of contributing activities in FLOSS projects. These findings can be transferred to the domain of enterprise wikis. It should be noted, therefore, that Lerner and Tirole (2002) found that in FLOSS projects reputation is supported by the publication of the names of the most active bug fixers. Indeed, wiki-based initiatives in enterprises, such as in our investigative context, typically make highly visible both forms of contributions by publishing the names of contributors and awarding badges to those that make significant contributions. Accordingly, we hypothesize:

H1: Reputational enhancement has a positive effect on both knowledge creation and knowledge integration.

3.3 Commitment to the Wiki

We define commitment to the wiki as the strength of an individual's identification with and involvement in the organization's wiki (Porter et al. 1974). Commitment is the psychological relationship between a person and another individual, object, or institution, and plays an important role within private as well as professional business relations (Mowday et al. 1979; Wallace

1995). We conceptualize commitment as an individual's psychological attachment to the enterprise wiki. We suggest there are two reasons commitment will motivate individuals to engage in KC and KI activities.

First, individuals committed to the enterprise wiki are more likely to be motivated to participate in its development. There is supporting evidence in the context of open source development and virtual communities, in which individuals who develop an attachment to the community are more likely to make contributions, including providing assistance to others (Raymond 1999; Wellman and Gulai 1999). In the FLOSS context, it has also been found that those that develop kinship with the community and, consequently, attachment to the community's initiative are motivated to participate in meaningful ways (Zeitlyn 2003; Lakhani and Wolf 2005; David and Shapiro 2008; Hars and Ou 2002). Meaningful participation in the context of open source development that is promoted by commitment to the community and its initiatives can include major tasks such as developing, debugging, and improving the software, as well as more mundane tasks such as field support (Lakhani and von Hippel 2003). This suggests that meaningful participation in the form of both KC and KI should be promoted by commitment.

Second, commitment is likely to mitigate concerns that individuals may otherwise have about losing a competitive advantage by sharing their knowledge through the wiki. Indeed, individuals will resist sharing their knowledge through organizational repositories if they are concerned about a loss of competitive advantage and subsequent loss of power (Jarvenpaa and Staples 2000; Cabrera and Cabrera 2002). To the extent individuals develop a commitment to the enterprise wiki, they are less likely to be concerned about such losses from engaging in knowledge sharing either through KC or KI. We therefore expect commitment to the enterprise wiki to promote both KC and KI, leading us to hypothesize:

H2: Commitment to the enterprise wiki has a positive effect on both knowledge integration and knowledge creation.

3.4 Enjoyment in Helping Others

We define enjoyment as the perception of pleasure obtained from helping others by contributing knowledge to a wiki (Wasko and Faraj 2000). We suggest that enjoyment in helping others through wiki knowledge contributions can motivate individuals to engage in KC and KI activities. Typically, helping behaviors require some extent of self-sacrifice and “the orientation to the needs of another that define acts as altruistic” (Krebs 1975, p. 1134). Past work has shown that sharing knowledge with one’s community can generate positive feelings and that achieving these positive feelings motivates individuals to partake in knowledge sharing. As such, we suggest that enjoyment in helping others through knowledge sharing in a wiki operates as a pro-social motive (e.g., Lindenberg 2001). There is supportive evidence that in the open source context enjoyment in helping others operates as a pro-social motive and promotes developers to contribute to the OSS development (Osterloh and Rota 2007).

In a study of 1,400 members of an open source community, Hemetsberger (2004) found 22 percent of the developers ranked altruism as a motivational factor to make contributions and that altruism was the strongest for those developers who contributed the most. Hars and Ou (2002) reported similar findings in their study of 389 persons involved in open-source projects. Finally, enjoyment in helping others, or altruism, has also been identified as an important factor motivating individuals to contribute to knowledge repositories within organizations (Wasko and Faraj 2005; Wasko and Faraj 2000).

Given that an individual's contributions to the enterprise wiki made through both KC and KI activities are directed at helping others, we expect that enjoyment from helping others will promote both types of knowledge sharing, leading us to hypothesize:

H3: Enjoyment in helping others has a positive effect on both knowledge creation and knowledge integration.

3.5 Organizational Rewards

Organizational rewards can be offered in the form of economic incentives to promote knowledge sharing to a wiki (Kankanhalli et al. 2005). The most common form of external motivational drivers are organizational rewards in the form of salary, bonuses, job promotion, or a supervisor's "pat on the back." Based on research in the domain of groupware and EKR, we can reasonably surmise a wiki will not be widely embraced that without appropriate incentives (Orlikowski 1993b; Wasko and Faraj 2005; Kankanhalli et al. 2005; Alavi and Leidner 2001). Although sharing knowledge within an organization is still a rather uncommon criterion for rewarding employees, firms in some knowledge-intensive industries (e.g., financial institutions, professional consulting) have begun to implement such rewards (Davenport and Prusak 1998). Contributors are even paid to participate in some FLOSS projects (Lakhani and Wolf 2005; Hertel et al. 2003; and Luthiger and Jungwirth 2007).

While organizational rewards have been identified as important drivers for knowledge sharing (Kankanhalli et al. 2005), we suggest they will have differential impacts on KC and KI. KC involves sharing one's specialized knowledge through the wiki, while KI involves integrating and synthesizing others' knowledge in the wiki (e.g., editing, rewriting and reorganizing wiki content). Consequently, individuals may be more motivated to engage in KC as it relates to showcasing the expertise they apply in their jobs, whereas extrinsic rewards may be more necessary to

encourage individuals to engage in KI. Moreover, performance evaluation systems are generally designed to assess and reward employees for job performance that derives, in large part, from their expertise and are not oriented to reward good organizational citizenship behavior (OCB) (Bergeron 2007; Rotundo and Sackett 2002; Allen and Rush 1998; Kiker and Motowidlo 1999). For example, Bergeron et al. (2013) found that time spent on task performance in an outcome-based control system is more important than time spent on OCB in determining career outcomes (i.e., performance evaluation, salary increase, advancement speed, promotion). Their results also show that time spent on OCB may negatively affect career outcomes. Consequently, KI behaviors should be motivated to a greater extent by the likelihood of external rewards perceived to be associated with knowledge sharing in a wiki. Hence, we hypothesize:

H4: Organizational rewards have a stronger positive effect on knowledge integration than on knowledge creation.

3.6 Codification Effort

We suggest that the effort required to codify and input knowledge into a wiki can affect knowledge sharing. The availability of technologies that allow for the exchange of knowledge does not necessarily translate into *de facto* use. In the case of knowledge repositories, creating such a public good requires private production costs or codification effort from many individuals. Since the public benefits are obtained (or consumption is enjoyed) for free (Wasko et al. 2009) but the costs are borne by individual contributors, there will be free-rider effects (Ba et al. 2001). Nevertheless, the existence of public goods such as Wikipedia illustrates that under the right set of conditions, enough people will be willing to share their knowledge for free in spite of the codification effort required to do so. Codification effort can be described as the costs associated with learning how to use the technology and contribute, format, and edit knowledge

(Goodman and Darr 1998). The time or effort required for codifying knowledge can be considered an opportunity cost (Kankanhalli et al. 2005); spending time sharing knowledge through a wiki system may keep one from doing something deemed more productive. Moreover, KC not only takes time and energy, but probably also gives rise to the need for additional effort later to respond to requests for clarification (Constant et al. 1996). In the case of KI, however, the burden is reduced to asking for clarification of already codified knowledge. Thus, we expect codification costs to have a stronger effect on KC than on KI.

H5: Codification effort has a stronger negative effect on knowledge creation than on knowledge integration.

4 The Empirical Study

4.1 The Enterprise Wiki Context

For our research, we were granted access to the wiki system of a global financial services provider based in Germany. The wiki was launched in April 2007 with the goal of providing a complementary channel for knowledge sharing. The wiki system was positioned as an opportunity to benefit from the knowledge of colleagues in the same and other locations. Given the company's global nature, this could include people residing on different continents who might not know each other personally. It was designed with the same look and feel as Wikipedia to minimize learning or switching costs for potential knowledge contributors already familiar with that wiki.

The corporate wiki aimed to provide a platform that would allow employees to generate and share knowledge without formal approval: everyone in the organization was allowed to add or

edit information. However, this meant that the quality of the wiki-based content depended on the authors' best knowledge and might not represent the company's official position.

While the original intent was to share knowledge on banking- and finance-specific topics, use of the wiki system grew to include information about projects or ongoing initiatives within the organization. Although users are advised that the knowledge provided in the wiki must be checked before it can be used as the basis for a decision, the system has become, for many, the first place to search for information. The number of pages has increased over time, and in March 2009 encompassed 6,117 articles.

4.2 Data Collection

We conducted our data collection in two phases. First, we collected data from the wiki archives, including general information about wiki users and their activities (e.g., how often they have created or modified wiki pages). We found that within the system's first two years, the 6,117 pages were modified 32,205 times by 2,270 wiki-registered employees of the bank. We also discovered that the wiki is used frequently (as measured by the number of visits) and that it shows high growth rates both in the number of active users and the number of contributions.

We also collected data from the corporate directory that allowed us to determine each wiki user's corporate division (line of business) and country of location. For our analysis, we used both "areas of the business" and "country" as control variables. Using the corporate division information, we split employees into three groups: technology and operations (groups responsible for processes, systems, and infrastructure), products and services (groups responsible for the delivery of products and services), and corporate functions (groups responsible human resources, legal, sourcing, and so on). In the later data analysis phase, we differentiated between users from Ger-

many, India, Singapore, the United States, and the United Kingdom—the biggest response groups—and the rest of the world.

In the second data collection phase, we developed an online questionnaire in both English and German to measure the constructs in the model. As the original measures were in English, we followed recommended procedures to develop the German version (Brislin et al. 1973). Two individuals proficient in both English and German translated the original survey instrument from English into German and then translated the German version back to English. They discussed any disparities and reconciled them, thereby ensuring the two versions would correspond. We designed the survey using an open source survey application called “Limesurvey”² and stored the survey data in a MySQL database. All items were measured on a seven-point Likert scale, from 1 (“strongly disagree”) to 7 (“strongly agree”).

In March 2009, we sent an e-mail invitation to participate in the survey to the 2,270 of the wiki users, with links to both the German and English versions. Users were informed that participation was voluntary and that their responses would be confidential. The invitation e-mail was accompanied by a separate e-mail from the organization encouraging employee participation. As a participation incentive, three iPods were awarded to randomly selected survey respondents. We enjoyed strong organizational support for our survey, achieving a response rate of 29.12 percent (n=661).

4.2 Sample Profile

Our sample included respondents from 33 countries; the highest proportion came from Germany (41.8%), the United Kingdom (15%), the United States (12.9%), India (7%), and Singapore (6%). We evaluated for non-response bias by comparing the profile of respondents to the profile

² <http://www.limesurvey.org/>

of targeted respondents. A chi-square test did not reveal significant differences between the proportion of registered wiki users in each country and the proportion of respondents from those countries. Some 59 percent of the respondents were from technology and operations, 20 percent from products and services, and 21 percent from corporate functions. Here again, a chi-square test did not reveal significant differences between the proportion of registered wiki users in different areas of the business and the proportion of respondents from each area of the business. As such, we found no evidence of non-response bias.

4.3 Control Variables

We included several control variables in our model. We obtained data from archival sources for the countries in which employee worked and for the employees' area of the business, and controlled for these differences using dummy variables. In addition, considering that they are factors that can affect knowledge sharing (Kankanhalli et al. 2005), we included self-efficacy, generalized trust, identification, and reciprocity as controls.

Table 2. Constructs and Measures		
Construct	Item Wording and Code	Source
Reputation (REPU): The perception of increase in reputation due to sharing knowledge in a wiki (Constant et al. 1996)	<ul style="list-style-type: none"> • I earn respect from others by participating in the wiki (REPU1) • I feel that participation improves my status within the organization (REPU2) • I participate in the wiki to improve my reputation within the organization (REPU3) 	Survey (questions adapted from Wasko and Faraj (2005))
Enjoyment (ENJY): The perception of pleasure obtained from helping others through knowledge contributed to a wiki (Wasko and Faraj 2000)	<ul style="list-style-type: none"> • I enjoy sharing my knowledge with others through the wiki (ENJY1) • I enjoy helping others by sharing my knowledge through the wiki (ENJY2) • Sharing my knowledge with others through the wiki gives me pleasure (ENJY3) 	Survey (Kankanhalli et al. (2005))
Knowledge Self-Efficacy (SE): The confidence in one's ability to provide knowledge that is valuable to the organization through a wiki (Constant et al. 1996)	<ul style="list-style-type: none"> • I have confidence in my ability to provide knowledge that others at the organization consider valuable (SE1) • Most other employees can provide more valuable knowledge than I can (SE2) 	Survey (Kankanhalli et al. (2005))
Commitment (COMM): The strength of an individual's	<ul style="list-style-type: none"> • I would feel a loss if the wiki were no longer available (COMM1) 	Survey (Wasko and Faraj

identification with and involvement in the organization's wiki (Porter et al. 1974)	<ul style="list-style-type: none"> I really care about the fate of the wiki (COMM2) I feel a great deal of loyalty to the wiki (COMM3) 	(2005))
Reciprocity (RECP): The belief that a contribution to a wiki would lead to a future request for knowledge being met (Davenport and Prusak 1998)	<ul style="list-style-type: none"> Other colleagues will help me by posting their knowledge to the wiki, so it's only fair that I help others in the same way (RECP1) I trust that my colleagues will help me much as I would help them by contributing to the wiki (RECP2) 	Survey (Wasko and Faraj (2005))
Organizational Rewards (RWD): The importance of economic incentives provided for knowledge sharing in a wiki (Ba et al. 2001; Hall 2001)	<ul style="list-style-type: none"> I share my knowledge through the wiki to get a better work assignment (RWD1) I share my knowledge through the wiki to be promoted (RWD2) I share my knowledge through the wiki to get more job security (RWD3) 	Survey (Kankanhalli et al. (2005))
Identification (ID): The perception of similarity of values, membership, and loyalty (Johnson et al. 1999; Shen et al. 2010)	<ul style="list-style-type: none"> My use of the wiki demonstrates that I am willing to put in a great deal of effort beyond that normally expected to help my organization to be successful (ID1) I find that my values and the values of my colleagues that use the wiki are very similar (ID2) I have learned from the active use of the wiki that people employed in my organization are working toward the same goal (ID3) 	Survey (Kankanhalli et al. (2005))
Codification Effort (COEF): The time and effort required to codify and input knowledge into a wiki (Markus 2001; Orlikowski 1993a)	<ul style="list-style-type: none"> I do not have the time to enter my knowledge into the wiki (CoEf1) It is laborious to codify my knowledge into the wiki (CoEf2) 	Survey (Kankanhalli et al. (2005))
Generalized Trust (TRST): The belief in the good intent, competence, and reliability of employees with respect to sharing and reusing knowledge (Mishra 1996; Putnam 1993)	<p>Based on my experience with the wiki I believe that people in my organization ...</p> <ul style="list-style-type: none"> give credit for others' knowledge where it is due (TRST1) only use knowledge that has been approved by our organization (TRST2) use others' knowledge appropriately (TRST3) share the best knowledge they have (TRST4) 	Survey (Kankanhalli et al. (2005))
Knowledge Creation (KC): The development and codification of new knowledge through the interplay of existing tacit and explicit knowledge possessed by an individual (Nonaka 1994)	<ul style="list-style-type: none"> I often share my knowledge by creating new pages for the wiki (KC1) I often add knowledge to the wiki pages created by others (KC2) 	Survey (new developed)
Knowledge Integration (KI): The synthesis of individuals' specialized knowledge so that it can be more readily leveraged across the organization to address specific needs (Alavi and Leidner 2001)	<ul style="list-style-type: none"> I regularly use the wiki to reorganize knowledge contributed by others (KI1) I often rewrite the wiki pages created by others (KI2) 	Survey (new developed)
Country	<ul style="list-style-type: none"> Location of the user 	Company records
Division	<ul style="list-style-type: none"> Area of Business / Corporate Division of the user 	Company records

4.4 Development and Validation of Measures

As Table 2 shows, we used established measures for most of our constructs and adapted them to our context. All constructs were modeled reflectively (except for generalized trust, which was modeled formatively). We followed recommended procedures to develop the survey items for the two knowledge-sharing constructs—that is, knowledge creation and knowledge integration—and assess the validity of all our survey measures (Churchill 1979; Straub 1989). To generate the items for these constructs, we reviewed relevant literature on knowledge management and online communities. We solicited feedback on the survey items from a panel of administrative personnel (i.e., those responsible for the wiki system) and users to ensure we had achieved adequate content validity and obtain feedback on the wording of questions and instructions. Based on their feedback, we made some adjustments to the instructions, length of the survey instrument, and wording of items.

Following recommended procedures, we evaluated convergent validity, construct reliability, and discriminant validity (Churchill 1979; Straub 1989; Hair et al. 2013). The PLS confirmatory factor analysis³ results revealed that items loaded much higher on the constructs they were intended to measure than on others (items for all substantive constructs loaded higher than 0.80 on their constructs) (Table 3). All loadings were greater than the recommended threshold of 0.708 (Hair et al. 2013), with the exception of one item for knowledge-sharing self-efficacy (a control variable) that had a loading less than 0.6. Given that this one item also had significantly lower cross-loadings on other constructs than on its intended construct, we retained it for subsequent analysis. The items for generalized trust are formative as they tap into distinct dimensions; as expected, their loadings are lower than for reflective measures. The weights for two of the four

³ Ringle, C.M./Wende, S./Will, S.: SmartPLS 2.0 (M3) Beta, Hamburg 2005, <http://www.smartpls.de>.

items were significant. However, we chose to retain all four items for content validity reasons (Petter et al. 2007).⁴ We also observed that the average variance extracted for all the reflective measures were greater than the recommended threshold of 0.5 (Hair et al. 2013), providing additional evidence of convergent validity. For reflective measures, we evaluated internal consistency reliability by computing both Cronbach's alpha and composite reliability as Cronbach's alpha is a conservative measure of internal consistency reliability (Hair et al. 2013). For all reflective measures, Cronbach's alpha and composite reliability were both greater than 0.8, providing evidence of good internal consistency reliability. Finally, as Table 4 shows, none of the item-construct correlations were greater than the square root of the average variance extracted, providing evidence of good discriminant validity. Cumulatively, the evidence suggests that all measures have acceptable reliability as well as good discriminant and convergent validity.

We also evaluated for common method variance (CMV), as the same respondents provided data on both the independent and dependent variables in our models. We applied the marker variable approach described by Lindell and Whitney (2001) and used by Malhotra et al. (2006). We examined the correlations among the survey items and identified the lowest correlation (RM1=.0097 between IDEN2 and KnSE2) and the second lowest correlation (RM2 = .003 between TRST1 and CoEF2). We computed the correlations among the study variables after correcting for RM1 and RM2. Adjusting for RM1, the maximum decrease in correlation was .009 and the average decrease in correlation was .003. Adjusting for RM2, we also observed very small decreases in correlations, with the maximum change being .01 and the average decrease being .005. These results suggest that common method bias is not a significant issue with our data.

⁴ All results are stable when only the two significant items are retained as a measure of generalized trust.

4.5 Hypotheses Testing

We used Partial Least Squares (PLS) to test our hypotheses. To test the three hypotheses pertaining to the direct effects on both KC and KI (H1, H2 and H3), we first specified a restricted model with only the control variables and then specified the full model that included all the theorized predictors. Table 5 shows our results. The restricted model with only the control variables explained 22 percent of the variance for both KC and KI and the full model with the control variables and all the theorized predictors explained 31 percent of the variance in KI and 34 percent of the variance in KC. In terms of the control variables in the controls-only model, identification and reciprocity were significantly associated with both KC and KI, while knowledge self-efficacy was significantly associated with KC and generalized trusting beliefs was significantly associated with KI. However, these control variables were not significant at $p < .05$ in the full models for KC or KI. All theorized constructs—reputation, commitment, enjoyment, rewards, and codification effort—significantly affect KC and KI.

Our results support our first three hypotheses pertaining to the direct effects on both KC and KI. We find that reputational enhancement has positive effects on KC ($\beta = .09, p < .05$) and KI ($\beta = .07, p < .1$), supporting H1. Commitment to the enterprise wiki has positive effects on KC ($\beta = .19, p < .01$) and KI ($\beta = .17, p < .01$), supporting H2. Enjoyment in helping others also has positive effects on KC ($\beta = .16, p < .01$) and KI ($\beta = .09, p < .05$), supporting H3.

The results also provide support for our differential effects hypotheses (H4 and H5). Organizational rewards have a stronger positive effect on KI ($\beta = .22, p < .01$) than on KC ($\beta = .15, p < .01$), thus supporting H4. Finally, we also find support for H5, as codification effort has a stronger negative effect on KC ($\beta = -.19, p < .01$) than on KI ($\beta = -.13, p < .01$).

To evaluate further the two hypotheses pertaining to the relative effects of organizational rewards and codification effort (H4 and H5), we followed the procedure to assess the relative effects of the same independent variable on two dependent variables from the same sample⁵ (Cohen et al. 2003, p. 642). Based on this procedure, we first computed the difference between the observed standardized KC scores, zKC , and the predicted standardized KI scores (\widehat{zKI}) obtained from the full model above with the control variables and the theorized predictors. We then specified a model with this absolute difference score, $zKC - \widehat{zKI}$, as the dependent variable and all control and theorized variables as independent variables. If a variable significantly predicts $zKC - \widehat{zKI}$, there is evidence that it differentially affects KC and KI, with a positive (negative) sign indicating that it influences KC (KI) to a greater extent. Table 6 presents the results.

The model explained 26 percent of the variance in $zKC - \widehat{zKI}$, indicating that KC and KI are differently affected by the set of variables in our model and providing further evidence of the distinction between KC and KI. The results of this procedure also provide support for H4, as organizational rewards have a negative effect on $zKC - \widehat{zKI}$ ($\beta = -.25$, $p < .001$), suggesting it has a stronger effect on KI than on KC; and H5, as codification effort has a positive effect on $zKC - \widehat{zKI}$ ($\beta = .05$, $p < .1$), suggesting it has a stronger effect on KC than on KI.

⁵ Cohen et al. (2003) caution that researchers mistakenly apply the procedures to evaluate the differential effect of two independent variables on the same dependent variable and elaborate on why these procedures are inferentially incorrect.

Table 3. Loadings and Cross-loadings for Measurement Items

	REPU	COMM	ENJY	RWD	ID	RECP	COEF	SE	TRST	KC	KI
REPU1	0.91	0.43	0.45	0.51	0.45	0.42	-0.11	0.29	0.34	0.37	0.37
REPU2	0.93	0.41	0.41	0.57	0.47	0.38	-0.13	0.32	0.35	0.36	0.36
REPU3	0.89	0.36	0.40	0.62	0.50	0.35	-0.13	0.29	0.34	0.38	0.39
COMM1	0.32	0.88	0.48	0.20	0.38	0.52	-0.25	0.23	0.25	0.36	0.27
COMM2	0.33	0.91	0.55	0.20	0.42	0.55	-0.25	0.28	0.28	0.38	0.28
COMM3	0.49	0.92	0.54	0.38	0.54	0.62	-0.28	0.32	0.40	0.50	0.46
ENJ3	0.44	0.53	0.91	0.24	0.47	0.53	-0.23	0.40	0.37	0.38	0.35
ENJ1	0.44	0.55	0.95	0.21	0.46	0.59	-0.24	0.42	0.37	0.43	0.35
ENJ2	0.41	0.55	0.95	0.18	0.44	0.57	-0.25	0.42	0.36	0.42	0.32
RWD1	0.60	0.32	0.26	0.95	0.53	0.32	-0.06	0.30	0.36	0.34	0.39
RWD2	0.54	0.21	0.14	0.90	0.44	0.18	-0.02	0.24	0.32	0.31	0.38
RWD3	0.53	0.24	0.15	0.86	0.44	0.20	-0.04	0.21	0.31	0.31	0.36
ID1	0.51	0.38	0.40	0.54	0.80	0.36	-0.13	0.29	0.35	0.36	0.30
ID2	0.34	0.40	0.35	0.36	0.81	0.48	-0.10	0.28	0.40	0.29	0.25
ID3	0.41	0.46	0.43	0.38	0.83	0.53	-0.17	0.31	0.47	0.32	0.32
COEF1	-0.13	-0.29	-0.27	-0.05	-0.16	-0.18	0.92	-0.08	-0.08	-0.33	-0.23
COEF2	-0.11	-0.20	-0.17	-0.05	-0.12	-0.17	0.81	-0.04	-0.06	-0.21	-0.16
SE1	0.21	0.29	0.46	0.09	0.26	0.32	-0.15	0.77	0.19	0.27	0.16
SE2	-0.25	-0.12	-0.09	-0.34	-0.23	-0.15	-0.09	0.57	-0.28	-0.13	-0.21
RECP1	0.38	0.60	0.58	0.24	0.55	0.94	-0.20	0.34	0.42	0.38	0.34
RECP2	0.41	0.58	0.54	0.29	0.48	0.93	-0.18	0.33	0.45	0.33	0.31
TRST1*	0.25	0.40	0.33	0.19	0.35	0.37	-0.04	0.20	0.47	0.16	0.14
TRST2*	0.18	0.06	0.16	0.26	0.24	0.13	0.13	0.21	0.53	0.12	0.21
TRST3*	0.28	0.37	0.33	0.22	0.42	0.43	-0.08	0.22	0.69	0.22	0.21
TRST4*	0.34	0.32	0.35	0.32	0.43	0.44	-0.14	0.29	0.92	0.26	0.31
KC1	0.39	0.46	0.43	0.34	0.40	0.35	-0.33	0.31	0.27	0.94	0.59
KC2	0.35	0.39	0.38	0.30	0.33	0.35	-0.25	0.25	0.25	0.90	0.66
KI1	0.40	0.38	0.36	0.41	0.35	0.34	-0.23	0.27	0.37	0.63	0.93
KI2	0.32	0.32	0.28	0.32	0.28	0.28	-0.18	0.20	0.21	0.57	0.85

*Formative measures for trust; weights for TRST1 and TRST3 were not significant.

Table 4. Descriptive Statistics, Correlations, and Reliabilities

Constructs	Mean	SD	Alpha	Rel.	1	2	3	4	5	6	7	8	9	10	11
Reputation (1)	3.93	1.38	0.90	0.94	0.91										
Commitment (2)	4.95	1.37	0.89	0.93	0.44	0.91									
Enjoyment (3)	5.43	1.13	0.93	0.96	0.46	0.58	0.94								
Rewards (4)	2.92	1.36	0.91	0.94	0.61	0.28	0.2	0.92							
Identification (5)	4.34	1.09	0.74	0.85	0.51	0.53	0.5	0.5	0.81						
Cost (6)	4.00	1.23	0.67	0.85	-0.13	-0.3	-0.3	-0.03	-0.2	0.86					
Knowledge-Sharing Self-Efficacy (7)	4.87	0.82	-0.16	0.63	0.32	0.31	0.44	0.26	0.36	-0	0.68				
Reciprocity (8)	5.07	1.20	0.85	0.93	0.43	0.64	0.62	0.27	0.57	-0.2	0.36	0.93			
Generalized Trust (9)	4.37	0.91	0.00	0.00	0.37	0.37	0.41	0.35	0.5	-0.1	0.33	0.47	n/a		
Knowledge Creation (10)	3.58	1.34	0.83	0.92	0.41	0.47	0.44	0.34	0.4	-0.3	0.29	0.39	0.28	0.92	
Knowledge Integration (11)	3.16	1.26	0.74	0.88	0.41	0.4	0.36	0.4	0.36	-0.2	0.26	0.37	0.34	0.68	0.89
Notes:															
1. Alpha = Cronbach's alpha; Rel. = Composite Reliability															
2. Square root of average variance extracted shown on diagonal; Formative measure used for generalized trust.															
3. Bolded correlations significant at $p < .05$ (two-tailed); italicized correlations significant at $p < .1$ (two-tailed)															

Table 5. Direct Effects on Knowledge Integration (KI) and Knowledge Creation (KC)

Control Variables	Knowledge Integration (KI)				Knowledge Creation (KC)			
	Beta	p <	Beta	p <	Beta	p <	Beta	p <
Country (Germany)	-.12	.02	-.12	.02	.06	.25	.04	.39
Country (USA)	-.03	.52	-.03	.51	.002	.58	.02	.64
Country (UK)	-.06	.19	-.06	.16	.002	.63	.01	.73
Country (Singapore)	.09	.02	.08	.03	.08	.04	.07	.06
Country (India)	.12	.004	.05	.19	.08	.05	.01	.77
Area of Business (Prod-Serv)	.004	.94	-.02	.61	.05	.30	.02	.60
Area of Business (Tech-Ops)	.04	.42	.02	.67	.06	.21	.03	.46
Generalized Trusting Beliefs	.11	.006	.08	.03	.03	.26	.000	.50
Identification	.12	.004	-.05	.14	.22	.000	.05	.17
Reciprocity	.18	.000	.06	.12	.20	.000	.01	.39
Knowledge Sharing Self-Efficacy	.05	.11	.01	.40	.11	.003	.06	.06
Internalized Extrinsic Motivation								
H1: Reputation			.07	.09			.09	.03
Intrinsic Motivation								
H2: Commitment			.15	.002			.19	.000
H3: Enjoyment			.09	.03			.16	.001
Extrinsic Motivation								
Rewards			.22	.000			.15	.001
Cost								
Codification Effort			-.13	.000			-.19	.000
Adjusted R-square	.223		.31		.22		.34	
Notes:								
1. Standardized coefficients are reported.								
2. Two-tailed tests for Country and Area of the Business; one-tailed tests for theorized directional effects and for control variables where directional effects are expected based on theory.								
3. Five dummy variables used for the six country categories (Germany, India, USA, UK, Singapore, rest of the world). Two dummy variables used for the three Areas of Business categories (technology and operations, products and services, corporate functions)								

Table 6. Differential Effects on Knowledge Creation and Knowledge Integration

Control Variables	Dependent Variable: $z_{KC} - z_{KI}$			
	Std. Beta	p <	Std Beta	p <
Country (Germany)	.28	.000	.26	.000
Country (USA)	.08	.08	.07	.11
Country (UK)	.13	.004	.13	.005
Country (Singapore)	-.09	.03	-.08	.06
Country (India)	-.13	.002	-.08	.04
Area of Business (Prod-Serv)	.05	.35	.07	.15
Area of Business (Tech-Ops)	-.008	.87	.000	1.00
Generalized Trusting Beliefs	-.17	.000	-.14	.000
Identification	.006	.45	.14	.002
Reciprocity	-.12	.004	-.09	.04
Knowledge Sharing Self-Efficacy	-.002	.28	.04	.14
Internalized Extrinsic Motivation				
Reputation			-.02	.31
Intrinsic Motivation				
Commitment			-.07	.09
Enjoyment			-.01	.43
Extrinsic Motivation				
H4: Organizational Rewards			-.25	.000
Cost				
H5: Codification Effort			.05	.09
Adjusted R-square	0.21		.26	
Notes:				
1. Standardized coefficients are reported.				
2. A positive (negative) sign indicates that a variable influences KC (KI) to a greater extent.				
3. Two-tailed tests for Country and Area of the Business; one-tailed tests for theorized effects and other controls based on theory				
4. Five dummy variables were used for the six country categories (Germany, India, USA, UK, Singapore, rest of the world)				
5. Two dummy variables were used for the three Areas of the Business (technology and operations, products and services, corporate functions)				

5 Discussion and Implications

Our study contributes to the IS literature in two important ways. First, building on prior work, we acknowledge that there are different types of knowledge sharing that occur in the context of enterprise wikis. Specifically, we conceptualize knowledge creation (KC) and knowledge integration (KI) as separate and distinct behaviors that can play an important role in the growth and evolution of an enterprise wiki. Second, we identify and analyze the effects of motivational and cost factors on KC and KI, providing strong empirical evidence that both extrinsic motivation (in the form of rewards) and cost (in the form of codification effort) yield different effects with respect to KC and KI. Specifically, we show that organizational rewards have a stronger positive effect on KI than on KC and that codification effort has a stronger negative effect on KC than on KI.

5.1 Implications for Research

Our results reveal that the three forms of motivation identified in the FLOSS literature—that is, internalized extrinsic motivation, extrinsic motivation, and intrinsic motivation—also affect knowledge sharing in enterprise wikis. In fact, our study reveals that each of these types of motivations is influential in affecting both KC and KI.

In terms of internalized extrinsic motivation, our finding that reputation affects KC and KI suggests that when employees perceive that they stand to gain in stature within the organization, they are more likely to contribute to the wiki through KC and KI activities. These results are broadly consistent with and extend the findings of Wasko and Faraj (2005), who reported that reputation was a significant predictor of the volume of contribution to knowledge management systems. In terms of intrinsic motivation, our finding that commitment affects KC and KI provides empirical evidence consistent with what Wasko and Faraj (2005) theorized in the context of knowledge management systems. Likewise, our finding that enjoyment in sharing knowledge

through the wiki affects both KC and KI elaborates on past work that has shown enjoyment to affect hedonic use while instrumental considerations such as perceived usefulness are more relevant for utilitarian use (van der Heijden 2004; Li et al. 2013). Given that knowledge sharing through wikis is largely an extra-role behavior, it is likely to be evaluated by employees, at least in part, as they would evaluate hedonic behaviors. Our results in this area are consistent with Kankanhalli et al. (2005), who found enjoyment in helping others to be a significant predictor of knowledge sharing.

In terms of extrinsic motivation, we found organizational rewards to be a significant predictor of KC and KI. These findings are consistent with and extend Kankanhalli et al. (2005), who reported a significant direct effect of organizational rewards on knowledge sharing. More important, we found that organizational rewards have different effects on KC and KI. Specifically, organizational rewards appear to be more important for KI in compelling participation than for KC. Our finding suggests that it will be useful to establish specific incentives to promote the KI-related citizenship behaviors required for the success of wikis. KC derives from employees' specialized knowledge related to their work and as such is likely to be rewarded through job performance appraisal systems. But the more mundane and often less obvious KI tasks involved in integrating knowledge contributed by others is unlikely to be captured in job performance appraisal systems. This finding also contributes to the broader literature on achieving organizational citizenship behavior (Bergeron 2007). Further, it has important implications for research, as the finding suggests that future studies on providing the proper incentives for knowledge sharing should focus more specifically on how to promote KI.

In terms of cost, we found codification effort to be a significant predictor of KC and KI. Our results are broadly consistent with Kankanhalli et al. (2005), who reported a negative but non-

significant effect of codification effort on knowledge sharing. More important, we found that codification effort has different effects on KC and KI. Specifically, codification effort is a greater impediment to knowledge creation than to knowledge integration. This finding has important implications for research: it suggests that future studies on reducing the cost people incur when they engage in knowledge sharing should focus more specifically on reducing the costs associated with KC.

5.3 Implications for Practice

A key insight from our study is that KC and KI are distinct behaviors in the context of enterprise wiki systems and that managers should think differently about how best to promote these two different forms of knowledge sharing behavior. In the early phases of wiki development, we suspect the emphasis needs to be on knowledge creation. Here, it is important that employees feel a strong sense of commitment to the wiki and that the wiki be designed to minimize the effort required to contribute knowledge. Based on the results of our analysis, these two factors appear to have the greatest impact on KC behavior. Almost equally as important, though, are architecting or selecting a wiki platform that will make the KC experience enjoyable for the user and providing appropriate incentives and rewards to motivate employees to create wiki content. One possible way to accomplish this is through gamification. KC behavior can also be fostered if people believe they can advance their reputations (e.g., status or respect) through knowledge sharing, although this appears to be a somewhat weaker factor. Nevertheless, management should establish mechanisms to make KC behaviors visible (e.g., listing the top wiki contributors) to enhance the stature of top contributors within the organization.

We suspect that once the initial content of a wiki is in place, the emphasis must shift to encourage knowledge integration while ensuring continued KC. In this way, additions, changes, and

refinements can be made to the knowledge that is created, and it can become a dynamic knowledge base that grows more useful over time as connections are made and the knowledge becomes more integrated. Here, it is important that management provide appropriate incentives and rewards to motivate employees to engage in knowledge integration. Based on the results of our analysis, this appears to be the single most important factor for encouraging KI behavior. Creating an environment in which people feel a strong sense of commitment to the shared knowledge repository, and designing a system that requires little effort to reorganize and add to knowledge created by others, will also promote KI behavior. While enjoyment and reputation can still be significant motivators, they appear to have less influence than incentives and rewards. Our results also suggest that cultural factors may be important in shaping whether an individual gravitates toward a KC or KI role, as some country differences appeared to be significant, suggesting that some cultures may promote KC over KI or vice versa. More research is needed to determine the role of cultural differences in KC and KI.

6 Limitations and Directions for Future Research

All research has limitations; this study is no exception. Our data were based on a cross-sectional survey and, as such, we must be cautious in asserting causality in the relationships we examined. Moreover, since we studied only one wiki system that was undertaken by a large financial institution, we cannot be certain the extent to which our results can be generalized to other systems and organizations. Further work is needed to determine whether our results can be replicated.

In this study, we relied on subjective perceptions. One obvious direction for future research would be to obtain and use objective metrics to examine knowledge-sharing behavior in the context of enterprise wikis. Another avenue would be to examine knowledge-sharing behavior using

a social network analysis perspective. This approach could reveal information of a different nature regarding how individuals' social structures in an organization influence their knowledge sharing through a wiki. Given that expressive and instrumental ties reflect very different relationships (Yuan and Gay 2006), future research can examine whether different types of ties lead to a greater propensity to engage in a particular knowledge-sharing behavior. It will also be interesting to elaborate the conceptualization of organizational rewards to differentiate between different types of rewards targeted at specific knowledge behaviors, as we limited our investigation to individuals' overall perceptions of gaining in pay, assignment, and job security as the result of contributing to the wiki. As our enjoyment construct captures enjoyment from sharing knowledge using the wiki (an altruistic motivator) and not enjoyment from using the technology, future research can evaluate how both types of enjoyment co-evolve and their respective roles in affecting knowledge sharing over time. Finally, an interesting direction for future research would be to compare the knowledge-sharing behavior of individuals in the context of enterprise wikis with knowledge-sharing behavior of individuals who are engaged in wikis outside the domain of the organization for which they work.

7 Conclusion

Electronic knowledge repositories in general, and wikis in particular, have the potential to improve how organizations build, store, and maintain knowledge by providing a useful platform for knowledge sharing. Unfortunately, many of these efforts fail. To improve the success rate for enterprise wikis, it is important that we gain a better understanding of the factors that drive distinct forms of knowledge-sharing behavior (i.e., knowledge creation and knowledge integration) and how to influence those behaviors.

The primary contribution of this study is in showing that the most influential factors driving KC and KI are different. Specifically, we provide empirical evidence that the strongest factors influencing KC relate to intrinsic motivation (i.e., commitment) and cost (i.e., codification effort), while the strongest factor influencing KI involves extrinsic motivation (i.e., rewards).

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