Enhancing E-Collaboration Effectiveness through the Use of Wikis: A Theoretical Examination in the Context of Requirements Elicitation

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ABSTRACT

This article focuses on communication challenges in requirements elicitation (RE) for systems development, and how wikis can enhance the communication process and outcomes in the context of this collaborative task. We focus upon only one specific collaborative task in this article – Requirements Elicitation – and upon one particular e-collaboration aspect of that task – communication among various stakeholders – to narrow the domain of inquiry and bring sufficient depth to our theoretical analysis. The specific variables we focus upon in this article are communications quality and requirements quality. We discuss specific wiki features and provide a brief comparison of wikis with other communication technologies. We then provide a detailed theoretical analysis of how specific wiki features enhance media richness, contextual richness, and organizational memory, and through them, communication quality as well as requirements quality in terms of clarity, completeness, and consistency of requirements specifications. We also discuss some implications and future research directions. [Article copies are available for purchase from InfoSci-On-Demand.com]

Keywords: Communication Quality; Contextual Richness; E-Collaboration; Media Richness; Organizational Memory; Requirements Elicitation; Requirements Quality; Wiki

INTRODUCTION

Web-based technologies are playing an ever-increasing role in the modern world and are proving to be both adaptable and extremely beneficial to a range of hitherto unsuspected applications. A recent, interesting development has been that of wiki-based systems, perhaps most familiar to the reader as the system underlying Wikipedia, a Web site that permits anyone anywhere in the world to interact collaboratively and participate in generating creative content towards the build-
ing of an online encyclopedia. The dynamics and success of Wikipedia presents researchers in a wide range of management disciplines with far-reaching possibilities in studying both its underlying dynamics and its applicative possibilities. These management disciplines include e-collaboration, collaboration engineering, knowledge management, social capital theory, structuration theory, information sharing, and communities of practice. Few scholarly works (e.g., McAfee, 2006) have addressed themselves to either a theoretical study of the processes at work in a group that uses a wiki-based interface as its interactive platform or to the question of how wiki-based systems could impact work processes if adapted to structured environments such as a business firm.

Wiki-based systems provide a promising new technology platform for e-collaboration. They possess certain features that bridge gaps existing in other collaboration technologies and address several points that have inhibited the diffusion of other e-collaboration technologies (McAfee, 2006). This article examines the possible ramifications of using a wiki-based system as the collaborative platform in the requirements elicitation (RE) task. In this article, we show that certain features existing in wiki-based systems conduce to improving the effectiveness of a requirements elicitation process.

We focus upon requirements elicitation to demonstrate the collaboration potential of wiki-based systems because requirements elicitation is a high-value, recurring task that requires a high degree of collaboration among systems developers and users (Coughlan, Lyckett, & Macredie, 2003). The study of RE is important because several surveys and studies (Browne & Rogich, 2001; Grünbacher & Briggs, 2001; Keil, Cule, Lyytinen, & Schmidt, 1998) have established that misunderstood, ambiguous, and incomplete detailing of requirements remain among the most important reasons behind systems failure. Communication is integral to any collaborative task and is all the more important in the context of an intensely interactive and collaborative task such as RE (Davis, Fuller, Tremblay, & Berndt, 2006). In this article, we focus upon only one specific collaborative task, that of requirements elicitation, and upon one particular collaboration aspect of that task, that of communication among various stakeholders, in order to narrow the domain of inquiry and to bring sufficient depth to our theoretical analysis. We explore how the features of wiki-based systems have the potential to enhance three important variables directly relevant to communication and collaborative work practices that lead to improved outcomes in the requirements elicitation task. These are the media richness, contextual richness and organizational memory that wiki-systems provide.

The RE qualities that are discussed in particular as benefiting from these variables are: the quality of communication within the larger RE team; and the requirements’ quality, which comprises of the clarity, completeness, and consistency of the requirements specifications. Certain other outcomes, such as the innovation and creativity fostered by certain novel technical features of wiki-systems; the effects of such factors on employee motivation and performance; and their impact on knowledge transfer, knowledge integration, and organizational learning, are briefly discussed in the final section dealing with implications and possible future research.

This article contributes to the literature on e-collaboration in two significant ways. First, it develops an understanding about some specific features of wiki—a rather recent technological innovation that provides a rich and interactive collaboration platform—that have the capability to enhance communication quality in high-value and intensely collaborative tasks. Second, it provides insights in terms of the mediating variables (i.e., media richness, contextual richness, and organizational memory) which enhance communication quality and collaboration outcome quality in the specific context of requirements elicitation. This is a significant contribution since enhancing the quality of requirements elicitation through the use of wikis could have a major impact on the systems development success.
The remainder of the article is structured as follows. The next section presents a general introduction to collaboration and e-collaboration. The subsection details the main challenges in collaboration. The next section has subsections giving a general introduction to wiki technology; a discussion of the specific features of wiki systems that have the potential to enhance communication processes; and a comparison of wiki-systems with several other communication technologies. In the section after that, we discuss requirements elicitation in the context of systems development and highlight some key communication challenges in this collaborative task. In the following section, we develop a conceptual model and theoretically analyze how wiki features enhance media richness, contextual richness, and organizational memory, and through them, communication quality as well as requirements quality in terms of the clarity, completeness, and consistency of requirements specifications. The final section provides a discussion of some implications of the insights that emerge from our theoretical model and some possible future research directions.

COLLABORATION AND E-COLLABORATION

In recent years, technological developments in communication have made it possible for companies to optimize their operations in a manner that was not hitherto possible by harnessing the benefits of dispersing their work processes across the world, a trend that is likely to grow in the future (Cramton, 2001; Evaristo, Watson-Manheim, & Audy, 2005). This calls for refinements in processes and technologies that facilitate collaboration, defined as “joint effort towards a group goal” (Kolfschoten, Briggs, & de Vreede, 2006, p. 17). Such collaboration over dispersed geographic locations is typically carried out using electronic technologies. Kock and Nosek (2005) quote Kock, Davison, Ocker, and Wazlawick (2001) to state that e-collaboration is “collaboration among individuals engaged in a common task using electronic technologies.” In theory, it is not necessary that e-collaboration takes place using the Internet (Kock & Nosek, 2005), yet it is remarkably apposite to being supported by Web technologies and other modern channels of communication and data exchange. Indeed, one may safely predict that Web technologies will soon become as indispensable to collaboration per se as they now are to regular communication within organizations.

Challenges in Collaboration

The challenges in collaboration arise from the changing character of the typical corporate organization. Although companies still retain their traditional structure, they are becoming both more interlinked with other companies and more diffused from themselves (DeSanctis & Monge, 1999; Majchrzak, Rice, King, Malhotra, & Ba, 2000). In order to maximize their competitive profile, companies are forming strategic alliances and outsourcing relationships with other firms and are themselves becoming more geographically dispersed and cross-functional (DeSanctis & Monge, 1999). This emergent type of organization depends critically on its functioning on communication (Aneona & Caldwell, 1992; DeSanctis & Monge, 1999). The centrality of communication to group work is universally endorsed, and a prolific stream of research in group support systems (GSS) is concerned with communication. Cramton (2001) identifies inadequate communication and the inability to retain contextual information as problems plaguing dispersed work groups. That article provided insight into some of the problems that arise from communication that is not face-to-face. These include “difference in the salience of information” (p. 357), which refers to what part of a communication is more important, urgent, or ambiguous, and of “interpreting the meaning of silence” (p. 359).

Several factors apart from communication have an impact on outcomes in the field of collaboration. Literature in the field examines issues like group cohesiveness, decision quality, and productivity (Grünbacher, Halling, Biffl,
Kitapci, & Boehm, 2004); the effects of group size and geographic dispersion (Chidambaram & Tung, 2005); the effects of perceptual load, access load, and conceptual load (Briggs, de Vreede, & Nunamaker, 2003); and the completeness and consistency of requirements elicitation (Grünbacher et al., 2004). Chidambaram and Tung (2005) study the effects of group size and geographic dispersion on the individual contributions of team members to the collaborative task and on the outcome of the same. That paper incorporates creativity-based criteria by using the number and quality of ideas generated by an individual as the measures of member contribution. It measures outcomes in terms of group cohesiveness and “quality of the final decision” (p. 159). In an empirical study of the mutual knowledge established between 13 geographically dispersed groups engaged in collaborative work, Cramton (2001) uses “decision quality” and “productivity” as measures of outcome.

A substantial stream of literature in the field of collaboration examines the efficacy of GSS. A GSS aims to overcome communication barriers and to structure the decision-making process in a work-group by “systematically directing the pattern, timing or content of discussion” (De Sanctis & Gallupe, 1987, p. 589). GSS tools are designed to enable structured communication among participants. They help to elicit often tacit values and knowledge, and help create a common vision among the stakeholders (Grünbacher & Briggs, 2001). GSS are typically employed to elicit the involvement of stakeholders and lead users towards meeting project goals (Bragge, Marttini, & Tuunanen, 2005).

Researchers have long been studying the dynamics of group work and the applicability of specific procedures, routines, and information systems that support such efforts. However, the results of these studies have not been consistent regarding the “effectiveness and efficiency” of systems supporting group work (Dennis & Wixom, 2001). Fjermestad and Hiltz (1998) present a very comprehensive literature review of such studies and report mixed findings. They find that the use of GSS tools led to no discernable improvement in performance in most cases. They find that performance was consistently poor across areas of specialization; even in “idea generation,” a field that is supposedly very amenable to improvement by using GSS, only 29% of studies actually reported any performance improvements. Shaw (1998) performed a meta-analysis of prior literature reporting on GSS studies that specifically measured user satisfaction and found no difference in satisfaction levels between groups that used GSS and those that did not.

Pinsonneault and Kraemer (1990) make a distinction between group decision support systems (GDSS) and group communication support systems (GCSS). Interestingly, they view the two as having “similar impacts on some aspects of group processes and outcomes, but opposite impacts on other aspects” (p. 143). Bragge, Relander, Sunikka, and Mannonen (2007) note that a distinction is occasionally made in the literature between GSS and GDSS, and that in such cases, “GSS refer to the technology-oriented and GDSS to the model-oriented streams of research.” DeSanctis and Gallupe (1987) provide a conceptual overview of GDSS, their purpose, components, and anticipated impacts. Theirs is an information-exchange view of GDSS and it approaches the topic from the perspective that “using a GDSS alters the nature of participation within the group, which in turn impacts decision quality and other group outcomes” (p. 590). This perspective is what we employ in this article to prognosticate the effects of employing a wiki-based system towards the same end.

**WIKI-BASED SYSTEMS**

**An Overview**

Modern technology innovations have thrown up numerous channels, ranging from e-mail to company Intranets, to aid communication and collaboration within an organization. As McAfee (2006) points out, these channels are typically limited either in their reach and scope
(e.g., e-mail, video conferencing, electronic brainstorming, etc.) or in their interactive capacity (e.g., company Web sites and Intranets). McAfee (2006) provides insight into the manner in which wiki-systems arch across existing communication systems to provide greater value to the organization. He classifies communication technologies currently available to knowledge workers into two broad categories: channels of communication, such as e-mail and instant messaging, and platforms, such as Intranets and company Web sites. He points out that the two are antipodal to each other in the manner in which content is created and distributed: in channels of communication, content can be created by anyone, but access is limited to a few; whereas in platforms, content is generated by inputs only from a few people but this is widely disseminated. Depending upon context, there are advantages to the employment of either form of communication. There are substantial and yet unexplored synergies to be garnered from implementing a system that combines critical attributes of both types of communication. Wiki-systems supply a technology and a means of carrying out collaborative work which combines the qualities of the two. By combining important characteristics of the two systems, wiki-systems could have the effect of eliciting "tacit knowledge, best practices and relevant experience from people throughout an organization and putting this information in a widely available database" (McAfee, 2006, p. 22).

A Wiki is collaborative software that allows users to add, remove, and amend content on a common platform, which can be a Web site or company Intranet (Hester & Scott, 2008; Schaffert, 2006). Wikis allow spatially dispersed users to create and develop documents collaboratively, using only a Web browser and simple typing skills (McAfee, 2006) and they support the uploading and sharing of graphics, images, and audio files (Schaffert, 2006). Users are able to revise all of these repeatedly, and all such versions are available for general use and scrutiny (Schaffert, 2006). Wikis are notable for their ease of use and the facility with which they enable interaction between users, and this renders them an effective tool for e-collaboration (Hester & Scott, 2008).

Wiki-systems being yet so novel, there is as yet very little literature available on them. An example may serve to illustrate in practical terms the possibilities that they offer to knowledge workers functioning in a distributed environment. Consider a scenario where a spatially distributed team is working on a project, perhaps concerning outsourcing to a foreign country. Let us see how this could typically progress with a wiki-system as the interactive platform: by doing little more than typing an appropriate name, a user, being any member of the team, could create a tentative page dealing with the project. This page would eventually give details about the project, mentioning perhaps the location, country, nature of goods to be manufactured, person in charge, and so on. Wikis tend to be profusely hyperlinked (Schaffert, 2006); hyperlinks from various words used on this page would lead interested users to separate pages about related content, perhaps radiating out to pages about the country's economic policy, industrial policy, land-use policy and so forth. Links from the main project page could link to various design options for the facility, including architects' drawings. Links from each of the various sub-pages could lead the user to relevant Web sites and online resources outside the wiki-system (Hester & Scott, 2008).

Critically, these project pages, graphics, and files would not merely be informative but also interactive. Users can not only create content and revise it repeatedly, but also interact with each other openly to discuss and resolve issues (Schaffert, 2006); the record of such discussions is available permanently to users who need such information even years later. Each of these project pages would be equipped with a "talk-page" for this purpose. Each user of the wiki-system would have a personal page which the user can personalize; no particular resource, except memory, is consumed, even for redundant use. Each such personal page would also have a talk-page associated with it, where messages meant for the user can be left. These messages, and the clarifications that emerge
for such one-to-one interaction, are available for all users to see and learn from. All of these would constitute a valuable resource of organizational memory. Permanent erasure of content is possible, but this function can be reserved for exercise by designated officials. In this way, users can discuss, depict, refine, and constantly improve, by mutual consent and discussion, every facet of the project at hand.

**Major Features of Wiki Systems**

Some of the major salient features of wiki-systems include:

- **Centralized and shared communication:** All communications and contributions can be made generally available to everybody else, and this access could be long-term (Schaffert, 2006). This includes both one-to-one discussions and discussions pertaining to a specific issue in the project. The former type of communication can be viewed as corresponding to the ubiquitous e-mails, but with one critical difference: they are available for all members of the project team to view. Thus, information is shared and solutions possibly proffered by experienced users even before a problem is encountered in the immediate instance.

- **Multi-type communication:** Charron-Bost, Mattern, and Tel (1996) classify communication into three types: synchronous, asynchronous, and causally ordered. Synchronous communication is when the parties communicate such that a response is immediate and a discussion ensues in real time, video conferencing being one example of such communication. Asynchronous communication does not provide real-time interaction; e-mail is a good example of this communication type. Causally ordered communication are those synchronous communications which “respect causal order, or where messages between two processes are always received in the order sent” (Charron-Bost et al., 1996, p. 173). The interactive system underlying wikis is inherently asynchronous (a user makes a communication without knowing when or whether the intended recipients have even received the same). However, with premediated cooperation, it is possible for two or more users to use the wiki-system synchronously also. Since communications on a wiki-system are time-stamped and are notified in the time-sequence in which they are sent, they may also be regarded as being “causally ordered.”

- **Multiple Access levels:** The system allows for users to be structured into a hierarchy, with various levels of users having different levels of both access and control. Files that have been deleted as redundant or undesirable can nevertheless be made available for viewing by users with the designated level of access, and can be recreated for general use at their discretion. Entire sections of the Wiki dealing with specialized and confidential subjects like finance may be “curtained off” for access only by a defined group.

- **Reliable ascription:** It is possible to track history both by contribution and by time of contribution, and the person making an edit can always be called to account. There are numerous benefits arising from this quality, and these have been enunciated elsewhere in this article.

- **Version vision:** All previous versions of a document or file are available for viewing (Schaffert, 2006). They can be accessed both in series, change by change, and each version can also be accessed directly.

- **Watch-listing:** A user can create a list of pages that are of interest and receive a notification whenever a change in any of these pages is made by any other user. This permits user-centralized tracking of projects and communications of interest.

- **Searchability and categorization:** Full text searchability exists (Schaffert, 2006). Access to communications that may be of relevance is also facilitated by the user-defined system of “categorization” or tagging (McAfee, 2006).
• **Internet access**: The system harnesses the benefits of being hosted on the Web. This renders collaboration possible any time and from any place, provided there is access to a Net connection. (Schaffert, 2006).

• **Scalability**: This feature flows mainly from wiki-systems being hosted online. Wiki-systems can be scaled to almost an indefinite extent, at nearly negligible incremental cost. It may be argued that even misuse of the wiki by the user-community (say, to exchange jokes) can be tolerated as no resource other than memory space is consumed and there is the intangible but substantial benefit of instilling team identification and cohesion.

Wiki-systems thus have many features that conduce to the creation of desirable work practices and group traits. These features give rise to numerous benefits. While this article explores only the benefits specific to requirements elicitation, there are numerous other benefits arising from factors like high levels of user adoption, the engendering of team identification and a sense of community, the creation of social capital, the related processes of knowledge transfer, knowledge integration, and knowledge creation, and the creativity that these processes elicit. Ease of use and usefulness lead to user adoption on a massive scale. The technology demands nothing more from the user than the ability to type and to communicate in natural language. High levels of creativity are elicited by both high user adoption and the scope for self-expression that the system permits. This process is also aided by the fact that a generally low level of hierarchy will arguably prevail in any wiki and the fact that information is being transferred across levels and across generations in the shared context of a project, organization, or field of work will conduce to elicit creativity in the community. Perhaps the most potent and important benefit arising from using a wiki-system is the sense of community and team cohesion that it engenders.

The next section presents a brief comparison of wiki-technology with other forms of communication.

**Comparison of Wiki Systems with Other Communication Technologies**

Among the technologies available to support collaboration amongst work groups, e-mail, teleconferencing, and video conferencing are the most widely used while Web-based tools and electronic meeting systems are the least favored (Bajwa, Lewis, & Pervan, 2003). With the increase in the variety and scope of communication tools, their usage has also increased over the past few decades (Nunamaker, Romano, & Briggs, 2001).

The pervasive tool of communication used in corporate environments today is the e-mail. A combination of utility and ease-of-use has made e-mail ubiquitous the world over. E-mail presents unmatched ease-of-use and a degree of functionality that is beneficial several magnitudes above any effort associated with its learning curve. E-mail is universal also in the sense that there is virtually no learning curve associated with switching service providers. By comparison, most collaboration software solutions are difficult to understand and evidence the presence of a learning curve.

However, there are other factors associated with e-mail that serve to undermine its utility as a tool of corporate communication, especially as a facilitator of group work. Sending e-mail back and forth within a group of users not only consumes considerable amounts of time but can also produce confusion regarding the sequencing of messages or the most current version of a collaborative document (Hester & Scott, 2008). E-mail communication is “noisy”: apart from spam and viruses, there is mail that is personal to the user but irrelevant to the work at hand; this constitutes a distraction and a drain upon the user’s own resources and that of the company (McAfee, 2006). This phenomenon can be significantly reduced by using Wikis. Since all communication on a wiki is accessible by
everyone else, a powerful inhibition of flippant or superfluous use inheres in the system.

Furthermore, e-mail places all communication into personal mailboxes, which are inaccessible to anyone except designated recipients. While e-mail is stored in centralized servers that the user can access from anywhere, the fact that the user alone can access personal mail could be a disadvantage in e-collaboration. In case several people have to communicate with each other, the proliferation of mail presents a problem that could overwhelm users (Hester & Scott, 2008). The problem of access to pertinent information arguably persists even in list-servers and bulletin boards, since in the absence of a searchable set-up, duly categorized or tagged, the presence of related information on two or more message boards or mailboxes cannot be easily detected. The wiki way of placing communication in a central location accessible by everyone, with search and categorization facilities, presents itself as a significant improvement in terms of reducing noise and providing ready access to relevant information and communication.

There is much discussion in the communities-of-practice literature that dwells upon the drawbacks of relying on communication that is not face-to-face (Chidambaram & Tung, 2005; Daft, Lengel, & Trevino, 1987; Majchrzak, Malhotra, & John, 2005; Valacich, Mennecke, Wachter, & Wheeler, 1994). One important point that emerges is that team members depend on body language and nonverbal cues to gather a sense of priority, urgency, and such other factors which are otherwise likely to be expressed ambiguously (Majchrzak et al., 2005). One communication technology that comes close to having the effect of face-to-face communication is video conferencing, which allows for the transmission of some nonverbal cues and body language between users. However, video conferencing is necessarily synchronous; it not only requires users to gather at specific locations at designated times but the complexity of the technology also restricts later review of proceedings. Video conferencing is not easily available at later times and is not searchable. It makes but little contribution to the retention and use of organizational memory. Video conferencing requires the presence of technology-support facilitators who handle the technology aspect of the meeting, something that is also generally true of electronic meeting systems (Munkvold & Zigurs, 2005). The technological complexity and the expense involved in video conferencing both compare very unfavorably with wikis.

This section has provided a general overview of wiki-technology and a comparison with other forms of communication, to familiarize the reader with this new technology. The next section provides an understanding of the field of requirements elicitation, which is the collaborative context in which the discussion concerning the ramifications of using wiki-based systems is developed.

**REQUIREMENTS ELICITATION**

A variety of management functions depend on collaboration for their successful implementation. In particular, requirements elicitation has been addressed from the collaboration perspective by several researchers.

Requirements elicitation represents the starting point for actual project development and affects every subsequent stage of the project. Grünbacher et al. (2004) quote the IEEE standard glossary of software engineering terminology to state that a requirement is “a condition or capability needed by a user to solve a problem or achieve an objective” (p. 14). A requirements document contains a set of detailed descriptions regarding the needs and wants of the customer. The generation of such a document is an intensely interactive process, comprising of several iterative steps aimed at negotiating an optimal and feasible set of client requirements (Kazman, In, & Chen, 2005). The meeting of these requirements is then the goal of the remainder of the project.

Requirements elicitation is the process whereby the needs of stakeholders are determined (Hickey & Davis, 2004). The success of the process is predicated upon stakeholder
involvement. In the field of information systems development in particular, requirements elicitation plays a critical role in determining the success of a project (Browne & Rogich, 2001). Failure is rampant in information systems development projects and many studies (e.g., Hickey & Davis, 2004) have observed or demonstrated that defects in requirements elicitation and failures in accurately gathering and documenting requirements have severe negative effects on project success. Accurately deducing project and user requirements is also crucial to curbing cost escalation resulting from the need to effect major corrections at a later stage (Bragge et al., 2005; Pitts & Browne, 2004). Successful requirements elicitation has proven difficult to achieve in practice, one reason being that the users themselves often have no clear idea of their optimal requirements, or what available technologies and features would provide them with additional support for their specific function (Davis, 1982). Thus, both the identification of desirable utilities and the communication of the same to the systems development team are uncertain. This effect, arising from poor end-user awareness of possibilities, is likely to be particularly pronounced in the case of emergent and rapidly changing information technologies (Davis et al., 2006).

Grünbacher et al. (2004) classify defects in RE as being those that are obtain due to the ambiguous use of language when users state their needs and those that are obtain at the negotiation level. Statements made by users are made or written in natural language and this can lead to errors, both when being expressed and when being interpreted by others. These statement-level defects correspond to the semantic boundary (Carlile, 2002) often encountered in knowledge management. When the question of functional domain-spanning communication arises, special attention to the issue of semantics is enjoined. As Davis et al. (2006) point out, dependence on standardized languages and techniques can in fact affect the communication process adversely. This effect is enhanced during a requirements elicitation process due to the diversity of stakeholders involved and the newness of the technology being contemplated. Criteria indicating the quality of outcome in RE include “completeness” and “consistency” of the elicitation and these quality criteria relate elicitation results to a set of expectations (Grünbacher et al., 2004).

In recent years, with the rise of offshore outsourcing, may work routines, including RE exercises, are increasingly being held across geographically dispersed groups of people (Dennis & Kinney, 1998). Ensuring that communication within the RE team on the one hand, and between them and the end-users on the other, is both adequate and rich becomes a critical success factor in the elicitation process. Such interaction, communication, and team vision need to encompass a diverse set of individuals during any RE exercise (Coughlan et al., 2003; Westfall, 2005). It is important to make sure that all success-critical stakeholders become adequately involved in the RE process. A number of definitions obtain in previous literature about what makes up the set of stakeholders connected to a project. These range from a broad concept like person or group influencing the focal firm to a far more restricted perspective like those involved in using or developing the system (Sharp, Finkelstein, & Galal, 1999). It may be generally held that a “success-critical stakeholder” is “any individual whose interests must be accommodated in order for the project to succeed” (Grünbacher et al., 2004, p. 19).

Sharp et al. (1999) present many definitions of “stakeholder” from previous literature and outline an approach to identifying stakeholders connected to a project in the specific context of requirements elicitation. Typical categories of stakeholders that should be considered success-critical in the requirements elicitation context are people “designing and developing a system, people interested in system use (e.g., end users or customers), people having a financial interest in the result, or people responsible for system introduction and maintenance” (Grünbacher et al., 2004, p. 19). Thus, a large group of people from varying backgrounds and with disparate interests needs to communicate in a collaborative and technology-mediated environment; a process rendered further onerous by the fact of
dispersed location and consequent premium on face-to-face interaction. Requirements elicitation is thus a boundary-spanning exercise for the individuals involved, and one that is predicated on effective communication through electronic media. The characteristics of the communication medium employed, such as media richness and the optimal mixture of synchronous and asynchronous communication, acquire great importance in this context.

THEORETICAL MODEL

We have seen in preceding sections that there are many features of wiki-systems that could provide value to communication and interaction in the context of requirements elicitation. We now present the model on which our discussion is based.

Figure 1 depicts the model that we develop in the succeeding subsections. The basic premise of our model is that the “wiki-features,” which are the salient features of a wiki-based system, provide a media-rich and contextually-rich medium of communication which enhances the quality of communication between users, all of which lead to improved outcomes in the collaborative task, requirements elicitation. The wiki-features also conduce to the creation and harnessing of organizational memory, which likewise results in improved RE outcomes. The various constructs and their functional definitions are listed in Table 1.

Requirements Quality

Prior literature in the field of requirements elicitation identifies many parameters whereby the quality of a requirements specification document may be gauged. In relation to a requirements negotiation process, Grunbacher et al. (2004) describe a quality assurance inspection process, wherein checking for clarity, completeness, and consistency are important elements. Based on this, we define requirements quality as being the composite of the completeness, clarity, and consistency of the requirements specification. A requirements elicitation process must be comprehensive within its defined scope and must elicit all requirements that are germane to the project. It is essential that all relevant requirements, including those that may otherwise have been overlooked or wrongly

Figure 1. Model of the impact of using a wiki-based system as the collaborative platform in requirements elicitation

<table>
<thead>
<tr>
<th>Wiki Features</th>
<th>Communication Enhancement</th>
<th>Requirements Elicitation Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Centralized, shared communication</td>
<td>- Media Richness</td>
<td>- Communication Quality</td>
</tr>
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<td>- Multi-type communication</td>
<td>- Contextual Richness</td>
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<td>- Net-wide access</td>
<td>- Organizational Memory</td>
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<td>- Scalability</td>
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<td>- Reliable ascension</td>
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<td>Requirements Quality</td>
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<td>- Version vision</td>
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<td>- Watch-list facility</td>
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<td>- Searchability</td>
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<tr>
<td>- Categorization</td>
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</tbody>
</table>
Table 1. Model constructs and definitions

<table>
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<tr>
<th>Sl. No.</th>
<th>Construct</th>
<th>Definition</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Requirements Quality</td>
<td>The composite of the Clarity, Consistency and Completeness of requirements elicitation</td>
<td>Grünbacher et al. (2004)</td>
</tr>
<tr>
<td>1(a)</td>
<td>Completeness in requirements elicitation</td>
<td>All relevant requirements, including those that may otherwise have been “missed or misunderstood,” (p. 83) have been properly identified.</td>
<td>Davis et al. (2006)</td>
</tr>
<tr>
<td>1(b)</td>
<td>Clarity in requirements elicitation</td>
<td>There must be no “potentially ambiguous terms and statements” (p. 23).</td>
<td>Grünbacher et al. (2004, p. 23)</td>
</tr>
<tr>
<td>1(c)</td>
<td>Consistency in requirements elicitation</td>
<td>There should be no contradiction between two statements.</td>
<td>Grünbacher et al. (2004)</td>
</tr>
<tr>
<td>2</td>
<td>Communication Quality</td>
<td>Quality of being “timely, helpful, and relevant to the task at hand.”</td>
<td>Stewart &amp; Gosain (2006, p. 298)</td>
</tr>
<tr>
<td>3</td>
<td>Media Richness</td>
<td>Capacity of communication media to provide feedback, communicate cues, be amenable to personalization and support language variety</td>
<td>Daft and Lengel (1986)</td>
</tr>
<tr>
<td>4</td>
<td>Contextual Richness</td>
<td>Availability of “context information about a message, structured for easy absorption.”</td>
<td>Majehrzik, Malhotra, &amp; John (2005, p. 11)</td>
</tr>
<tr>
<td>5</td>
<td>Organizational Memory</td>
<td>“Stored information from an organization’s history that can be brought to bear on present decisions”</td>
<td>Walsh &amp; Ungson (1991, p. 61)</td>
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interpreted, have been properly identified (Davis et al., 2006). These requirements should be put down in clear terms. All statements must be clearly understandable and should leave no scope for wrong or innovative interpretations; any specialized terms used must be defined in a glossary in order to decrease the possibility of misinterpretation and to avoid disputed and unnecessary discussion at a later stage (Grünbacher et al., 2004). The requirements thus specified must be consistent with each other in statements, facts, assumptions, processes, and nuances. There should be no contradiction between two statements that have been agreed upon (Grünbacher et al., 2004). A rigorous requirements specification must evidence all these qualities, and this is cumulatively referred to by us as “requirements quality.”

Communication Quality

Requirements elicitation is an intensely interactive process and almost every study connected to requirements elicitation comments upon the centrality of communication to the process. This is particularly true in the increasingly common situation where much of the elicitation process is technology mediated. Problems inherent in such communication include the inability of the receiver to assess what part of a communication is more important or urgent, and what to make of the lack of communication from the other party (Cramton, 2001). Inadequate communication and the inability to contextualize information are important problems plaguing dispersed work groups. Communication is most useful if it is “timely, helpful, and relevant to the task at hand” (Stewart & Gosain, 2006, p. 298). The completeness of an RE exercise requires timely access to all relevant information. This takes on a richer meaning in the context of correctness and completeness, as defined by Grünbacher et al. (2004), which is to confirm that “each issue really is a constraint or objection, and each option really suggests a solution” (p. 23). Points raised should not be unnecessary or superfluous, and it typically
requires communication with several users to reliably ascertain such points.

As we have seen, an RE exercise involves the participation of many stakeholders with different roles (Coughlan et al., 2003; Kazman et al., 2005; Westfall, 2005). Diversity of domain expertise is a necessity in the elicitation process, since the remit of the project is for software engineers to design systems intended for the use of non-technical people. As has been mentioned above, the diversity of stakeholders could result in two types of diametrically opposite problems. On the one hand, the lack of a shared specialized vocabulary and of shared understandings could constitute a formidable semantic boundary-spanning exercise (Carlile, 2002) for the individuals involved. On the other hand, the opposite effect can also evidence itself on occasion: dependence on standardized languages and techniques can in fact affect the communication process adversely (Davis et al., 2006). Either phenomenon can result in stakeholder alienation and decrease participation in collaborative processes; this is known as the “immediacy gap” (Chidambaram & Tung, 2005). We see that deficient quality of communication between stakeholders serves to undermine the quality of the requirements elicitation both inherently and due to reduced stakeholder participation. It is thus evident that communication quality has a direct and significant impact on the quality of requirements elicitation.

**Media Richness**

The richness of communication media employed for interaction plays a critical role in determining the outcome of a requirements elicitation exercise. According to Montoya-Weiss, Massey, and Song (2001), “media richness is determined by a medium’s ability to provide immediate feedback, utilize multiple cues and channels, and enable language variety” (p. 714). Information richness has been defined by Daft and Lengel (1986) as the “ability of information to change understanding within a time interval” (p. 560). Shephered and Martz (2006) quote Poole and Jackson (1990) in defining information richness as “the capacity to facilitate shared meaning among communicators” (p. 116). During face-to-face interaction, communication takes place over more channels than we easily appreciate. Information is communicated not only verbally (both in words and by tone, inflection, and volume of voice) but also non-verbally by way of facial expression, body language, and eye contact. This immensely rich interaction allows for the conveyance of tacit understandings and unspoken signals and serves to regulate and modify communication (Daft et al., 1987). It eliminates inadvertent ambiguity and provides a reliable means of conveying urgency, unofficial disinterest, and such other attitudinal signals. The use of a technology to mediate communication reduces the richness of this interaction; these facilitative tools invariably embed certain constraints on communication. Shephered and Martz (2006) speak of a “technology lens” inherent in all media that impacts communication either by restricting the flow of information or by causing some participants to miss some of the information completely.

Shephered and Martz (2006) describe two ways in which this limiting effect is mitigated. Based on the social information processing theory, they posit that the limitations of the media will cause communication to be prioritized: users will use the limited channel to process task-oriented communications to the extent possible, and more social communications may follow if circumstances permit and inclination exists. The second likelihood is posited by them based on adaptive structuration theory, according to which users figure out ways to send cues and signals based upon what the media technology supports. Emoticons that convey attitudes such as sarcasm and surprise are cited as examples of this trend. This behavior is known as “appropriation,” which refers to “the manner in which structures are adapted by a group for its own use” (Gopal, Bostrom, & Chin, 1992, p. 47). These theories suggest that social and task messages ultimately get conveyed over most media channels (Shephered & Martz, 2006); however, these efforts require high levels of
motivation and are associated with significant payoffs in terms of time and effort. Apart from the impact that constrained communication may have on immediate work outcomes, being parsimonious and rigorously task-oriented with communication will also have an impact on team dynamics and the creation of both relational social capital (e.g., trust) and cognitive social capital (e.g., the creation of shared perceptions and understandings), as defined by Nahapiet and Ghoshal (1998). The devising of appropriation techniques have the additional impediments of being chancy and requiring time and prolonged usage to become widely understood in the user community. The basic assumption underlying these theories is that the richer the media technology, the more effective it will be in transferring information, thereby leading to higher performance or satisfaction.

Daft and Lengel (1986) identify four criteria that determine the richness of a given communication media, namely: the capacity of feedback, the capacity of the medium to transmit multiple cues, the use of natural language, and the extent of personalization possible. Judged by these criteria, a wiki-system presents users with a rich medium of interaction, covering all the four criteria. The availability of feedback and “personal focus” are primary features of a wiki-system, which inherently uses natural language. Real-time feedback can be received depending on the presence and attention of the other users. A message posted on the user’s message board causes the user to be alerted instantly if the user is on the system and upon logging in if the user is not. While message alerts are found in many other systems, certain other innovative features enhance the communication and feedback between users. These include the “watch-listing” concept in which users can add pages of interest to a personal watch-list. These can include personal pages of other users. When an edit is made on those pages by another user, that fact is made known to people who have the page on their watch-list. Thus, they are unobtrusively prompted every time an edit of possible interest is made, and they can provide feedback to the user who made the edit. This prompting occurs when a user chooses to review the watch-list; it is therefore unobtrusive and a user is not inundated with constant and untimely promptings. Messages left specifically on the user’s talk-page trigger an instant prompt, and if the user is logged on the system at this time, a real-time discussion may follow. All discussion is in natural language, and no structure is imposed on communication. The experience in regards to providing or receiving feedback is enhanced by what we in this article term the “version vision” feature. What this means is that all previous versions of a document or file are available for viewing by anybody. They can be accessed both in series, change by change, and each version can also be accessed directly.

Wiki-systems also allow for the transmission of multiple cues. They support emoticons that enrich communication, and allow users to present each other with symbolic tokens of regard. Furthermore, the “edit summary” feature allows the user to include an edit summary, a very concise statement of the change that has been made, and the reasons thereof. On the watch-list, this summary will cue the users to the nature of the change at first glance, and save the effort of investigating change. Apart from communication and feedback, the personal focus of wiki-systems is also evident in the page personalization that it allows for, and in the accountability that it provides. Personal pages can be designed as per a user’s taste, and some studies (e.g., Whitworth, Gallupe, & McQueen, 2000) have discussed the effects of personalization on group cohesion, group identity, and group interaction.

Wiki-based systems thus provide increased media richness for communication between users, which significantly enhances the quality of communication between users and conduces to higher requirements quality.

**Contextual Richness**

Context can be defined as being “information about the situation, intentions, and feelings about an issue or action, as owned, evolved, and represented by each individual involved.
in the communication process” (Majchrzak et al., 2005, p. 11). Several studies have observed that meaningful and complete communication requires knowledge of the context in which interaction occurs. This is particularly true in the context of technology-mediated communication, where the possibility of surmising context from nonverbal cues is negated and there are obstacles to immediately seeking and receiving clarification regarding context (DeSanctis & Monge, 1999). This effect is exacerbated in the case of group communication, where a message, intervention, or contribution from one user may not be addressed specifically to another user. In such an environment, the system should allow scope for a user to discover the context of a communication independently and in an easy, accessible manner.

A critical utility of a system that mediates communication in an organization is therefore the extent to which it supports the contextualization of communication. Contextualization can be defined as being the “presentation of context information about a message, structured for easy absorption” (Majchrzak et al., 2005, p. 11) in the context of distributed cognition. Boland, Tenkasi, and Te’eni (1994) present a set of six design principles which we summarize in Table 2. The six points identified by them are: ownership, analogous to our “reliable ascription”; easy travel (ease of navigation); multiplicity (of perspectives); indeterminacy; emergence; and mixed forms (multimodality). Although Boland et al. present these design principles in the context of distributed cognition, the same may be adapted to define an IT-supported contextualization paradigm.

Ownership as defined by Boland et al. (1994) refers to the user taking responsibility for an interpretation or action in the distributed cognition context. In the context of a collaboration platform, the ownership construct is similar to being able to reliably attribute responsibility for every action to the concerned individual. We have already touched upon what we have termed the “version vision” feature of wikisystems which provides users with access to all previous versions of a page or file. An important attribute of this facility is reliable ascription: every available version of the file and every edit made and comment added to a page can be ascribed, without confusion, to the person who

<table>
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<tr>
<th>Sl. No.</th>
<th>Construct</th>
<th>Definition</th>
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<tr>
<td>1</td>
<td>Ownership</td>
<td>Users must assume responsibility for their views and actions.</td>
</tr>
<tr>
<td>2</td>
<td>Emergence</td>
<td>System should allow for the emergence of “new concepts, categories and levels of representation” (p. 467) and for higher level entities to emerge from the synthesis of existing relationship sets</td>
</tr>
<tr>
<td>3</td>
<td>Easy travel</td>
<td>A hyperlink-like feature should enable users to move effortlessly from one element to another, through “text and context” (p. 466).</td>
</tr>
<tr>
<td>4</td>
<td>Mixed Form (Multi-modality)</td>
<td>System should enable the user to use a choice of modes of expression, such as textual, visual and audio.</td>
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<tr>
<td>5</td>
<td>Indeterminacy</td>
<td>System should be unstructured enough to allow users to share information and ideas that are as yet somewhat vague or incomplete.</td>
</tr>
<tr>
<td>6</td>
<td>Multiplicity of Perspectives</td>
<td>System should enable users to “compare and contrast” (p. 467) different interpretations and perspectives of an issue or a message. Manual comparison at the least should be possible; automated comparison is ideal.</td>
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*Table 2. Constructs comprising an IT-supported contextualization paradigm*

Adapted from Boland et al. (1994)
made it. Every edit ever made to a page, from the moment of its inception, can be reviewed and analyzed. Additionally, a wiki-system provides the added benefit of allowing users to know the time and sequence on every action, which is also crucial in surmising context.

All the content available can be readily accessed due to the system of page categorization which is user-created and therefore inherently intuitive. This corresponds to the “emergence” quality identified above. Page categorization creates an overarching, higher level entity that is the synthesis of the lower level entities and points to some commonality between them as stipulated by Boland et al. (1994). Thus, every individual project could have its category, as could every page dealing with a certain topic that could be of relevance to several projects. This provides broader perspective on the issue, as well as easy access to resources connected to the specific point of interest. Categorization is only one of several features that provide ease of navigation, which is another of the points identified above. Hyper-linking of pages forms the central feature of connectivity to pages with related content, and the search function provides ready access to other pages that are not directly connected and to other types of information. As has been noted elsewhere in this article, the wiki-system supports not only textual but also graphical and audio modes of communication, thus meeting the criterion of mixed form or multimodality.

An interesting quality identified by Boland et al. (1994) as being important to distributed cognition is indeterminacy. Technology-mediated communication is too often stilted and constrained by the structure that is imposed by the technology. It should be recognized that half-developed ideas are a rich source of creativity and innovation. Also, most problems at work are vaguely visible at a preliminary stage to some involved personnel. The inability to place such problems before a larger audience and gain feedback shuts away a rich source of problem-solving assistance. In the requirements elicitation field, this problem could be particularly pernicious because there could be a range of requirements that are unsuspected by the RE analyst and are only vaguely recognized, if at all, by the end user (Davis et al., 2006). The only way these requirements can be identified is if vague and imprecise cognitions are articulated in natural language. In this context, the inherent lack of structure in wiki-systems becomes one of its great strengths and a strong determinant of completeness of requirements elicitation. Not only is indeterminacy supported in natural language, but no particularly valuable resources are expended in the process; nothing but memory space on the server is taken up by even irrelevant and needless interaction between users. Indeed, such interaction can also be viewed as an antecedent of positive team dynamics.

Related to indeterminacy is the concept of multiplicity of perspectives. Diversity of opinion and perspective is critical to any creative team exercise. From the RE perspective, this is an important antecedent of “clarity” and “completeness.” Diversity of perspective can not only bring unsuspected issues into focus but could also provide perspectives on why a requirement that has been put forward is not actually necessary. Wiki-systems support not only such diversity but also allow for comparison of views alluded to in previous sections. It is possible to compare two perspectives on any issue side-by-side (Schaffert, 2006), and this meets the comparison criteria identified by Boland et al. (1994). In the requirements elicitation context, this comparison function conduces to achieving the “consistency” criterion of an RE exercise.

Wiki-based systems thus increase the contextual richness of communication between users, which significantly enhances the quality of communication and conduces to higher requirements quality.

Organizational Memory

Communication and information exchange within an organization remains highly dependent upon personal interaction. This is especially so for information falling in the grey area between “tacit” and “explicit,” as defined
by Nonaka (1994). It is often small bits of information about individual customers, their past interactions with other employees of the company, what approach would click with them, and such other microlevel intelligence that an employee needs on a day-to-day basis to do a job better. This type of intelligence has been termed “organizational memory” in strategic management literature and has been widely recognized as being an important organizational resource.

Walsh and Ungson (1991) refer to organizational memory as “stored information from an organization’s history that can be brought to bear on present decisions” (p. 61). Nilakanta, Miller, and Zhu (2006) define organizational memory as the “collection of historical corporate knowledge” (p. 85) that is harnessed for current use. They observe that effective knowledge management enables organizations to “avoid repeating past mistakes, ensure the continued use of best practices and draw on the collective wisdom of employees, past or present” (p. 85). They find that organizational memory is typically either ignored or lost; it is rarely available for corporate collaborative processes. This results in employees expending resources and effort on reinventing the wheel, and it also exacts a price on the organization in terms of mistakes being repeated and valuable organizational learning being lost (Nilakanta et al., 2006). Organizational memory provides information that reduces transactional costs, contributes to effective and efficient decision making, and it is also a basis for power within organizations (Nilakanta et al., 2006).

Organizational memory, as a resource, abides in most organizations, and it is traditionally the boss/mentor figure in a department or workgroup who functions as the repository of such knowledge and imparts it as necessary to the group. Although this is a hoary and living tradition in many organizations, the dissemination of such information has traditionally been highly dependent upon personal interaction; people in a different workgroup housed even in the same premises as a person holding helpful information are unable to tap the willing-and-able source due to lack of access and coordination. An organizational Wiki would supply precisely this lacuna by allowing for easy contact between query and answer among functionally- and spatially-dispersed seeker and source. Furthermore, this information would be available for everyone else in the organization to access and reference for all time to come; this “organizational memory” does not depart with the person. That information could also be refined, improved, and modified in future. It is also both searchable and categorized, as McAfee (2006) notes, in an intuitive manner by user consensus. The record of interaction is updated dynamically and is structured such that former versions of the information are never destroyed but are always available.

In the context of requirements elicitation, access to instances and records of prior transactions and interaction provides users with precedent that could serve as a guide as they negotiate circumstances that to them may be novel. The resort to precedent can indicate pitfalls to be avoided with regard to the completeness and clarity of the requirements specification. Special attention can be paid to areas that have proved problematic in the past and the scope of repeating mistakes would be substantially reduced. The RE process itself could be made consistent, overall, with similar efforts in the past. Furthermore, templates could be developed that would guide the RE process, depending upon typical project characteristics identified at the inception of the project.

Wiki-based systems thus provide a platform for the conservation of organizational memory and facilitate stakeholder access to that resource, which significantly conduces to higher requirements quality.

**IMPLICATIONS AND FUTURE RESEARCH DIRECTIONS**

One major limitation of our article stems from the scope that we have defined for it. A principal goal of this article is to develop an understanding of wiki-technology. We present the salient
features of a wiki-based system and point out how these may enhance efficiency of outcome in a particular specialized task. However, technology alone does not determine outcomes; there are a myriad other factors, whether organizational, structural, or human in nature, that would interact with the technology to impact on outcomes. This limitation in our study opens up several avenues for future research. The impact of using wiki-systems could be investigated from the perspective of adaptive structuration theory, which posits that the organization impact of a technology depends at least as much on how people use a technology as on the salient qualities and utilities provided by the technology itself (DeSanctis & Poole, 1994). As DeSanctis and Galupe (1987) say in another context, researchers may study the interaction of technology and its users with respect to the “nature of the group’s cognitions, actions and feelings, and the relationship between these attributes of information exchange and decision outcomes.” Future studies in this direction could examine the effect of group size, group cohesiveness, trust levels, task-orientedness, and other such factors on usage and outcomes.

There is immense scope for research on the group dynamics associated with using a wiki-based system. This can be viewed, for instance, from the organizational knowledge management (Orlikowski, 2002) and social capital (Adler & Kwon, 2002) perspectives. Possible outcomes of using wiki-systems, such as the innovation and creativity arising from its novel technical features, the enhanced scope for self-expression, the effects of these factors on employee motivation and performance, their impact on knowledge transfer, knowledge integration, and organizational learning, and other such factors are all open to study by researchers.

Media richness as pertaining to wiki-based systems itself makes for several immediate projects. For instance, while Valacich et al. (1994) find that media characteristics and richness mattered significantly to subjects as they performed tasks of various characteristics, and Shephard and Martz (2006) found that greater media richness led to higher satisfaction levels, others studies present findings that raise questions about whether greater media richness being beneficial is indeed a universal truth. Shephard and Martz (2006) tabulate a number of studies that report mixed results, and report inter alia that Martz and Shephard (2004) find that richer media environments were associated with lower levels of consensus. Dennis and Kinnery (1998) found no support for the idea that matching media richness to task equivocality could result in improved performance. Alavi, Marakas, and Yoo (2002) found in their study, interestingly, that rich media environments had lower learning outcomes and vice versa. Using the media richness perspective, issues such as the effect of task characteristics on outcomes in a wiki-based system and the effect of using wiki-based systems on user satisfaction, consensus levels, and other outcome variables can be investigated.

Alignment of technology with other organizational elements has been found to be very important from the perspective of effective use of new technologies within organizational settings (Kishore & McLean, 2007) and this opens up another avenue for future research in this area. It is entirely conceivable that alignment of organizational roles and responsibilities, tasks, and control systems with the new wiki technology also has an impact on outcomes from the usage of this new technology. Therefore, alignment related variables should also be included in an enhanced model of outcomes of wiki usage in requirements analysis and/or other task contexts.

The verification of the model proposed in this article after operationalizing the constructs involved is another project that immediately suggests itself. Several of the constructs, such as completeness, consistency, clarity, and media richness have been extensively dealt with in prior literature; indeed, scales to quantify and measure some of these constructs already exist. This is a theoretical article and it provides immediate scope for applicative research. This could involve the design of specific, repeatable work processes, thinklets, and templates based on wiki-systems and related to the elicitation
process. Another approach to extending the work of this article could involve examining the potential use of wikis in other high-value collaborative tasks. Modeling the use of a wiki-system as a platform for collaborative functions like group decision making, consensus-building brainstorming, and idea generation can be explored. The influence of task type and task complexity, and also the extent of perceived task nonroutineness on outcomes obtained when using wiki-based systems, can all be investigated (Kishore, Agrawal, & Rao 200, 2005).

The Wikipedia Web site is the preeminent representative of broad-based wiki-systems, and if there is any lesson to be learnt from its stupendous and continuing success, it is this: A wiki-based system elicits enthusiastic user participation and thereby builds social capital and team dynamics that can only be described in superlatives. What features and traits underlie this phenomenon, whether they are applicable to a corporate environment, and if so, whether such application would enjoy similar success, are all questions awaiting the analysis of social and management researchers.

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