Journal of the Association for Information Systems
JAIS

Research Article

Usability and Sociability in Online Communities: A Comparative Study of Knowledge Seeking and Contribution*

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Abstract

The chief objective in many online communities is to allow for knowledge sharing and learning, which is enabled by technologies such as discussion forums. The value realized from these communities depends on ongoing participation in terms of two key activities i.e., knowledge seeking and contribution. However, a large number of communities fail, as they cannot sustain these activities. This poses the question of how these two activities can be simultaneously promoted. While previous research has separately explicated a number of different antecedents for the two activities, this study adopts a socio-technical perspective of an online community and considers usability and sociability as two salient antecedents applicable to both activities. Usability and sociability are multi-dimensional constructs, where individual's perceptions of the two may be determined by dimensions such as ease of use and social interactivity. This paper proposes that individuals may place different importance on these dimensions when seeking knowledge, compared to contributing knowledge. The research model is tested through a survey of users of a learning-focused community system. Our findings indicate that individuals do, indeed, differ in their emphasis on the identified dimensions when they engage in the two activities. Specifically, ease of use and system reliability are considered as more important for usability, and moderator perception as more important for sociability when individuals seek knowledge. On the other hand, individuals perceive tracking fulfillment as more important for usability and social interactivity as more important for sociability when they contribute knowledge. These differences have implications for future research and practice.

***Keyword**: Online communities, Usability, Sociability, Knowledge seeking, Knowledge contribution, Measurement invariance*

*Suzanne Rivard was the accepting senior editor. This article was submitted on March 25, 2008 and went through two revisions.

Volume 10, Issue 10, pp. 721-747, October 2009

1. Introduction

Online communities have become increasingly prevalent in recent years (Butler, 2001; Jones et al., 2004; Ma and Agarwal, 2007). They involve a collection of people who communicate and interact openly with each other in a computer-supported virtual space to seek some shared purposes, which is guided by a set of community policies and rules (de Souza and Preece, 2004; Preece, 2000). Examples of these purposes include the provision of emotional support, entertainment, knowledge sharing, and commerce. Despite the significant growth in the number of these communities, relatively few communities are successful in attracting members (Ma and Agarwal, 2007), and many do not take off at all or turn into "cyber ghost towns," i.e., initially active communities that are subsequently abandoned (Preece, 2001). For instance, it was observed that over 90 percent of users of online forums – including AOL, MSN, and Slashdot – do not participate by posting in the forums (Katz, 1998; Nielsen, 2006). In order to ensure the sustainability of online communities for their intended purposes, it is important to understand how to promote participation in them.

In this study, we investigate a popular type of online communities that are created for the explicit purpose of knowledge sharing and learning. These communities have been shown to provide value through supporting mutual learning among the participants (Charalambos et al., 2004; Gray, 2004; Jones and Preece, 2006). The open interaction space enabled by the underlying technology, e.g., the discussion forum system, is considered important for mutual learning (Barab et al., 2001; Bruckman, 2002). Charalambos et al. (2004) noted that these communities may support learning through providing an "environment where participants can freely express their opinions and ask questions" (p. 138). The less hierarchical, informal nature of interaction among the participants, guided by shared purposes, can encourage an open exchange of ideas that is conducive to participants learning from each other in these communities (Charalambos et al., 2004; Gray, 2004; Jones and Preece, 2006). However, the value derived from these knowledge sharing communities can only be realized when there is ongoing participation, which often does not occur (Butler, 2001; Ma and Agarwal, 2007). Thus, it is important to investigate how participation in these communities can be promoted.

Online communities for knowledge sharing and learning essentially involve member participation in terms of knowledge contribution (as suppliers of knowledge) and knowledge seeking (as consumers of knowledge). From a knowledge market perspective (Davenport and Prusak, 1998), a lack of either one of these activities would render the knowledge sharing process incomplete and ineffective (i.e., high demand but no supply, or high supply but no demand), and drive members away from the community. For the sustainability of these communities, it is, therefore, imperative to understand how to promote and balance both activities (Davenport and Prusak, 1998; Wenger, 1998).

For this purpose, most prior studies that investigate the antecedents of knowledge seeking and knowledge contribution have explicated a number of *individual motivational factors* for using various s ystems (e.g., for electronic repositories) in different settings (e.g., organizational communities of practi ce). Individual motivational factors include the desire for reputation (Jeppesen and Frederiksen, 2006; Peddibhotla and Subramani, 2007; Wasko and Faraj, 2005), monetary incentives (Kankanhalli et al., 2005a, 2005b; Peddibhotla and Subramani, 2007), information need and knowledge growth (Kankanhalli et al., 2005b; Ma and Agarwal, 2007), and self-efficacy (Kankanhalli et al., 2005b).

However, there is less research that has attempted to *translate the motivational factors into a set of n eeds and requirements of users in an online community*. For instance, previous studies have highlight ed the importance for an online community system to make users' contributions visible and identifiabl e (Ling et al., 2005; Ma and Agarwal, 2007; Subramani, 2004), so that they will continue to share kno wledge. Such requirements may arise from an individual's desire to gain recognition from other comm unity members and obtain monetary incentives in the context of organization-sponsored communities (Ling et al., 2005). Rafaeli and Sudweeks (1997) underscore the need for an online community syste m to facilitate interaction among participants. The interactivity afforded may provide the basis for indivi duals to obtain benefits such as enjoyment and satisfaction with interaction in the community.

Following from the above approach of identifying users' needs and requirements in an online commun ity, there is an emerging stream of research that investigates individuals' participation based on a *soci o-technical perspective* (Maloney-Krichmar and Preece, 2005; Preece, 2000, 2001). Research along this line argues that online communities, as virtual spaces enabled by technologies that afford interpersonal communications, can be viewed as socio-technical systems that consist of both technical and social components (Kling and Courtright, 2003; Trist and Murray, 1993). The socio-technical framework highlights *usability* and *sociability* as two corresponding perceived characteristics of a community system that may promote members' participation, both in terms of seeking and contribution (Maloney-Krichmar and Preece, 2005; Preece, 2001). We make use of this approach to a ddress our objective of understanding how member's perception of an online community system can be managed to promote both knowledge contribution and seeking activities.

Usability refers to the capability of a technical system to be used easily and effectively by individuals t o fulfill their tasks, such as to seek or contribute knowledge (Shackel, 1991). The technical system for an online community is often a discussion forum system that allows people to exchange ideas, post q uestions, and offer answers and help. It also typically provides ways of archiving and searching for pr evious exchanges. More recent literature in online communities has begun to investigate how such sy stems may support members' social interaction for the attainment of community shared purposes, ref erred to as *sociability* (Maloney-Krichmar and Preece, 2005; Preece, 2001).

In the context of knowledge sharing, allowing for social interaction is a unique feature of online community systems such as discussion forums, compared to other types of knowledge management tools such as electronic knowledge repositories (EKR). EKRs enable the codification and storage of knowledge rather than interaction among individuals, and typically include mechanisms for acquisition, control, and publication of knowledge (Kankanhalli et al., 2005a). Typically, knowledge contributors may be required to fill in templates and have their knowledge items validated by experts prior to inclusion in the EKR. In contrast, online learning communities generally encourage open interaction and have less structured procedures so that informal learning can take place among the participants (Charalambos et al., 2004; Gray, 2004; Jones and Preece, 2006). Message contributions in these communities are usually moderated lightly as needed (e.g., to remove flaming) so as not to stifle the open nature of the interaction space.

Both usability and sociability in an online community are multidimensional in nature, in that individuals ' perceptions of the two may, in turn, be determined by dimensions such as ease of use of the technical system, and social interactivity of the community space (Lazar and Preece, 2002). In this paper, we propose that individuals may be more sensitive to certain dimensions when evaluating the usability and sociability in an online community for seeking knowledge, compared to when they are contributing knowledge. Specifically, we seek to address the following research question:

> *Do individuals perceive different levels of importance on various dimensions of usability and sociability when seeking knowledge vs. when contributing knowledge?*

This research is expected to make the following contributions. First, previous studies on knowledge sharing have typically focused either on knowledge contribution (e.g., Bock et al. 2005; Kankanhalli et al., 2005a; Wasko and Faraj, 2005), or on knowledge seeking (e.g., Kankanhalli et al., 2005b; Zhang and Watts, 2003), or pooled them together (e.g., Jarvenpaa and Staples, 2001). There is a paucity of theoretically-grounded research that *systematically compares the two types of knowledge sharing activities to understand how both can be simultaneously promoted*. Thus motivated, we develop a theoretical model based on the socio-technical perspective to investigate both knowledge seeking and contribution through which comparison between the two activities can be made.

Second, existing studies on usability and sociability have primarily relied on ethnographic or case study methods (e.g., Alem and Kravis, 2005; Barab et al., 2001; Jones and Preece, 2006; Maloney-Krichmar and Preece, 2005; Wright and Street, 2007). This study aims to extend the previous knowledge by *quantitatively validating the importance of usability and sociability perceptions* in a syst ematic manner. Also, we attempt to conceptualize and operationalize the two constructs by identifying *a parsimonious set of their dimensions relevant to the context of online communities for knowledge sharing*

and learning.

Third, our study can contribute to existing literature investigating participation in online knowledge sharing communities for mutual learning. Much of previous research in this area has focused on describing the characteristics of these communities and suffers from a lack a theoretical grounding in the inquiry (e.g., Bruckman, 2002; Charalambos et al., 2004; Gray, 2001). Among the few exceptions, Barab et al. (2001) discussed how communities supporting learning can be developed along the usability and sociability aspects, but they did not validate the importance of these two aspects on individuals' participation in the communities. Jones and Preece (2006) employed two community cases to demonstrate the importance of usability and sociability, while Tolmie and Boyle (2000) investigated the role of shared purpose, which is related to sociability through a case study method. Our study aims to add to this line of research by developing a comparative theoretical model grounded in the socio-technical lens, and quantitatively validating the model compared to the qualitative means employed in previous research (Jones and Preece, 2006; Tolmie and Boyle, 2000).

Fourth, this study investigates how individuals value usability and sociability dimensions differently when seeking knowledge compared to contributing knowledge, through the lenses of value theory and social exchange theory. The findings from this study may provide managers and champions of online communities with *insights about how individuals' perceptions of the community system can be better managed to promote both knowledge sharing activities*. Individuals' perceptions of an information system are central to understanding their behavior of using the system (Davis et al., 1989; DeSanctis and Poole, 1994). Such perceptions of a system may vary according to an individual's understanding and use of the system, which explains why different outcomes can result from use of the same system (DeSanctis and Poole, 1994; Griffith, 1999). For instance, individuals' perceptions about the usefulness of a technology in enhancing job performance (Davis et al., 1989) have been established as a determinant of their technology acceptance. Therefore, practitioners may strive to shape such favorable perceptions of individuals in order to obtain desirable outcomes, such as increased use of the technology. In the next section, we will discuss the theoretical development and comparative research model of this study.

2. Theoretical Development and Model

2.1. Theoretical Perspectives

This study adopts the overarching theoretical perspective of viewing an online community as a *socio-technical system* (Kling and Courtright, 2003; Trist and Murray, 1993). This perspective suggests that online communities, as virtual spaces enabled by technologies that afford interpersonal communications, can be seen as socio-technical systems that consist of both technical and social components. It highlights perceived usability and sociability (Maloney-Krichmar and Preece, 2005; Preece, 2001) as the corresponding antecedents of participation both in terms of member's knowledge seeking and contribution through the community system (discussion forum system in our study). Recognizing that the two constructs are multidimensional in nature, we first identify their underlying dimensions. Our aim is to derive a parsimonious set of dimensions of the two constructs that are relevant to our study's context, i.e., online communities for knowledge sharing and learning. Based on the identified dimensions, we then derive their relative importance to individuals when they seek knowledge compared to when they contribute knowledge via the lenses of value theory and social exchange theory. The resultant comparative research model is shown in Figure 1.

Value theory holds that different individuals may judge and attach different value to an object or a concept based on how it can satisfy their needs (Harper, 1974; Moser, 1997). Consequently, the same object may be judged as relatively more important by one person than another, depending on what the person's need is and the role played by the object in fulfilling her need. For instance, an individual who needs to rely on a capability of a system to fulfill a key task may judge it as more important than another individual who does not have such a need.

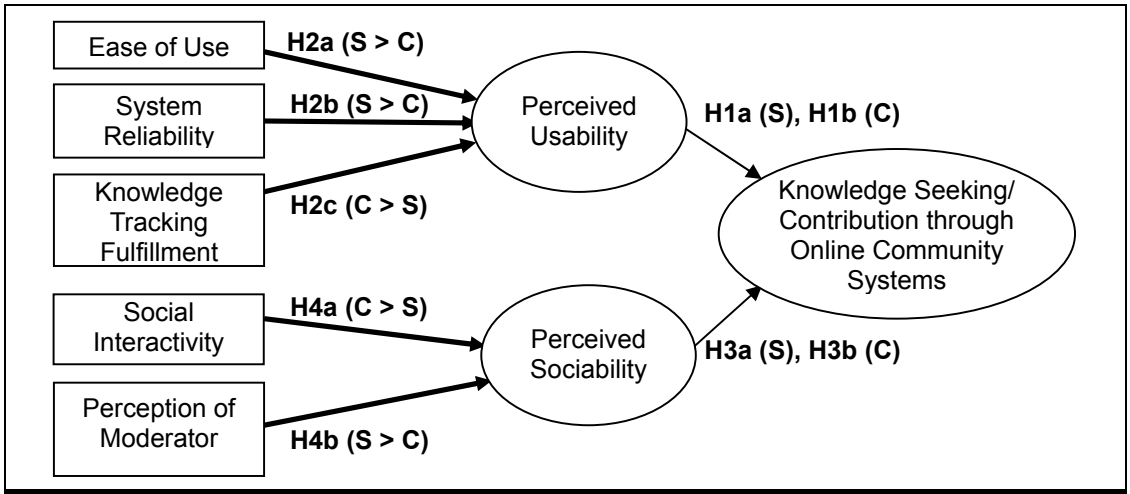

Figure 1. Comparative Research Model

Note:
Labels in rectangular boxes denote dimensions of the formative construct, i.e., Perceived Usability and Perceived Sociability.
Arrows in bold indicate comparison between how the particular dimension is weighted by individuals when seeking knowledge (S) vs. when contributing knowledge (C).
S > C indicates that the particular dimension is hypothesized to have a higher weight for seeking knowledge compared to contributing knowledge, and vice versa for C > S.

Another lens through which to understand the relative importance that individuals may attach to an object or concept is *social exchange theory* (Blau, 1964), which can inform how such a valuation is likely to be made in exchanges such as knowledge sharing. Social exchange theory posits that individuals engage in social exchanges based on an expectation that they will lead to some form of net benefit (Wasko and Faraj, 2005). Knowledge sharing through an online community system can be seen as a generalized social exchange (Fulk et al., 1996), where individuals contribute and receive resources from different people. Resources that act as the currency of social exchange can be tangible or intangible, and may constitute the costs (resources given away) or benefits (resources received) during an exchange. By understanding whether a usability or sociability dimension can help in realizing the desired benefits for the knowledge resources expended, we may deduce whether the dimension will be perceived as more important by individuals when contributing knowledge as compared to seeking knowledge.

It should be noted that our use of the social exchange theory is different from previous studies such as Kankanhalli et al. (2005a) and Wasko and Faraj (2005). The latter researchers employ the theory as a framework to organize a set of pertinent benefit (motivator) and cost-related (demotivator) factors for knowledge contribution. In this study, we employ the social exchange theory to derive the relative importance of a dimension to individuals when seeking knowledge compared to contributing knowledge.

2.2. Usability

Usability is an established concept in the human-computer interaction (HCI) literature (Hornbæk, 2006). It has been defined as the capability of a system to be used easily and effectively by individual s to fulfill their tasks (Shackel, 1991), and the quality of a system that makes it acceptable to users (H olzinger, 2005). From these definitions, it becomes clear that a system with high usability is important to ensure its attractiveness to users (Löwgren, 2002), and consequently, usability has been found to be positively associated with increased system usage (Lecerof and Paterno, 1998, Nielsen, 2000). Lik ewise, we expect that individuals' perceived usability of the system enabling an online community (a discussion forum system in this study) will positively influence their seeking and contributing knowledge in the community.

H1a: Perceived usability is positively related to knowledge seeking.
H1b: Perceived usability is positively related to knowledge contribution.

Usability is a multifaceted construct that has been measured in various ways for different types of systems with different groups of users performing specific tasks (see Hornbæk (2006) for a review). Most conceptualizations of usability in prior research agree that usability is context dependent (Newman and Taylor, 1999; Preece, 2000) and is shaped by the inter-relationships among tool, task/problem, and people (Hornbæk, 2006). In this study, we conceptualize usability in the context of an online community system (tool) employed by community participants (people) to seek or contribute knowledge (task/problem). Our aim is to identify a parsimonious set of usability dimensions in this context that is applicable to individuals when they seek knowledge as well as when they contribute knowledge. We achieve this by conceptually juxtaposing the tool, task/problem, and people elements (Hornbæk, 2006) in the context of our study. To derive the usability dimensions from the elements of tool, task/problem, and people, we look at the interaction of each pair of elements and identified the concept that best characterizes the interaction.

We first focus on the *people and tool* elements. Much of the extant research on IS use has identified antecedents that focus on the *interaction of people with tool* when performing a task, such as ease of use, learning and mental effort, and the effort of interacting with a system (Davis et al., 1989; Hornbæk, 2006; Miller, 1971; Preece, 2000). These can be captured through the concept of *ease of use*, which refers to the degree to which using a particular system is perceived to be free of effort (Davis et al., 1989; Venkatesh, 2000).

Shifting to *tool and task/problem* elements, the focus here is primarily on the *tool and its state of being able to facilitate an intended task*. This focus should be carefully differentiated from people's interaction with a tool (as described in the previous paragraph) and people's active needs arising from performing a task (as discussed in the next paragraph). The concept of *system reliability,* which refers to whether a system is stable, robust, and available to facilitate a task whenever it is needed (Shneiderman, 1998), fits this focus.

For the interaction between *people and problem/task*, the primary focus is on *people as active agents who have needs to be fulfilled while performing a task*. In the context of knowledge sharing, people need to be recognized for their effort of contributing knowledge, and to identify knowledge sources for seeking knowledge (Kankanhalli et al., 2005a, 2005b; Wasko and Faraj, 2005). Thus, online community members need to be able to track their knowledge activities as well as those of others in the community. This leads to the identification of *knowledge tracking fulfillment* (Goodman and Darr, 1998) as the third dimension of usability. It refers to the extent to which individuals perceive that their need to track knowledge activities can be fulfilled via the online community system.

While we identify ease of use, system reliability, and tracking fulfillment to be important usability dimensions, these dimensions may be weighted differently when individuals seek knowledge compared to when they contribute knowledge in online communities, as discussed below.

Ease of Use

Ease of use refers to the degree to which using a particular system is perceived to be free of effort (Davis et al., 1989; Venkatesh, 2000), and is an established indicator of a system's usability (Lazar and Preece, 2002; Miller, 1971). We expect individuals to place greater importance on ease of use in evaluating usability when they seek knowledge compared to when they contribute knowledge.

Seeking via an electronic system is a form of problem solving that requires cognitive efforts in performing a sequence of tasks using the system (Marchionini, 1995; Xie and Cool, 2000). Knowledge seeking in a discussion forum typically involves the use of a search tool or browsing through the forum to locate the knowledge needed, and possibly posting a new query when the knowledge sought is not available. Collectively, these activities require substantial interaction with the discussion forum system. For instance, the use of search tool entails a sequence of tasks that may include locating the search button, examining the search fields and options available (e.g., advanced

features that restrict results to a specified time period), executing the search (e.g., typing the search terms into the fields provided, or using the advanced search features), browsing through the results list, sorting the results (e.g., by dates, occurrence of search terms, or in alphabetical order), and re-performing the search execution if necessary (e.g., narrowing down the search using the advanced search features).

In contrast, knowledge contribution using a discussion forum system typically involves a more straightforward and limited sequence of interactions with the system, primarily consisting of populating a web form and clicking on the "submit" button to contribute.[1] Although contributors may also browse through the forum to ensure that a knowledge item to be contributed is not already in the forum, the onus is not on contributors to do so.

From the perspective of value theory, ease of use is likely to be perceived as more important by individuals when seeking knowledge as compared to contributing knowledge, given that an easy-to-use system would imply minimum effort required for them to obtain the knowledge that they need for problem solving. This is especially so due to the relatively more complex interaction with the discussion forum system that is typically required in seeking knowledge compared to contributing knowledge, as previously discussed. Therefore, we expect the ease of use of the system to be of greater concern in usability evaluation when individuals seek knowledge. This leads to the following hypothesis:

H2a: In evaluating usability, ease of use will be given greater importance when seeking knowledge compared to when contributing knowledge.

System Reliability

The reliability of a system means that the system is stable, robust, and available in supporting a task whenever it is needed (Shneiderman, 1998). In an in-depth ethnographic study, Maloney-Krichmar and Preece (2005) observed that an important concern of members of an online community is its reliability, i.e., the community system needs to be "a reliable means of communications" (p. 210) and "available 24 hours a day, 7 days a week" (p. 227).

Reliability of the technology supporting the online community (in this study, a discussion forum system) may be particularly salient when seeking knowledge. When individuals engage in knowledge seeking, they are using the discussion forum system to locate the knowledge that they need for problem solving (Marchionini, 1992). In other words, they are relying on the system to obtain knowledge needed in a timely manner (Maloney-Krichmar and Preece, 2005). On the other hand, when individuals contribute knowledge, they do not require the system for problem solving, nor is knowledge contribution likely to be a time-critical task. Based on the value theory (Harper, 1974; Moser, 1997), system reliability is likely to be perceived as relatively more important in usability evaluation when individuals seek knowledge, given that a reliable system would allow them to obtain knowledge when they need it. From an inverted perspective, an unreliable system may cause seekers to not be able to obtain knowledge at the time of need. But for contributors, they can still contribute knowledge at a later time without suffering the loss that seekers do. Hence, we hypothesize:

H2b: In evaluating usability, system reliability will be given greater importance when seeking knowledge compared to when contributing knowledge.

Knowledge Tracking Fulfillment

Knowledge tracking fulfillment refers to the extent to which individuals perceive that their need to trac k knowledge activities can be fulfilled by the online community system, e.g., discussion forum. A discu ssion forum system may fulfill this need by maintaining a trail or record of knowledge sharing activities

[1] It is important to note that ease of use of a system does not include the efforts of seeking/contributing knowledge that do not involve interacting with the system, e.g., in formulating search terms in knowledge seeking (Xie, 2003); and in externalizing knowledge in knowledge contribution (Markus, 2001). In our study, ease of use is defined and operationalized accordingly.

, including the tracking of a poster's particulars (e.g., nickname or real name, number of postings mad e) for each posting, and the date/time when the posting was made, number of responses received for each posting, and all postings made by a poster. These capabilities enable members' postings to be made visible and identifiable (Ling et al., 2005; Ma and Agarwal, 2007; Subramani, 2004), and provide a basis or indicator of whether a shared knowledge item has been useful or relevant (Goodman an d Darr, 1998).

Previous studies have investigated why individuals are willing to contribute knowledge to help others despite the time and effort needed to do so (e.g., Kankanhalli et al., 2005a; Wasko and Faraj, 2005). An important motivator identified for such behavior is individuals' desire for reputation (Wasko et al., 2004; Wasko and Faraj, 2005). The ability to track knowledge activities may provide individuals with a basis for realizing these incentives when they contribute knowledge. This is because a trail of their contributions is maintained, and this trail can be traced and evaluated later by other members. Consequently, individuals who contribute high-quality knowledge may get to enjoy an enhanced reputation or related forms of incentives within the community. Additionally, individuals may also be able to obtain feedback (in the form of responses to a posting) on whether their contributed knowledge has been relevant or useful if their contribution activities can be tracked.

When individuals seek knowledge, the ability to track knowledge activities in the community may facilitate their seeking of desired knowledge. For instance, they can employ the number of contributions made by each individual to identify active contributors in the community from whom to seek knowledge (Goodman and Darr, 1998). Thus, such an ability may serve to augment individual's knowledge seeking, in addition to the search function provided by the system.

However, based on the social exchange theory, the fulfillment of knowledge tracking is likely to be perceived as relatively more important when individuals contribute knowledge compared to when they seek knowledge, given that contributors would expect incentives in return for the costs incurred in contributing knowledge (Kankanhalli et al., 2005a). Knowledge tracking fulfillment may give them a higher confidence that the incentives for their knowledge contribution effort in the community can be materialized. For seekers, the ability to track knowledge might *augment* the existing search functions, but it does not provide additional incentives for seeking knowledge. Individuals may still be able to obtain the knowledge needed through the search functions without the ability to track knowledge in the community. Therefore, knowledge tracking fulfillment is not likely to be perceived as critical by seekers as by contributors. This leads us to the following hypothesis:

> *H2c: In evaluating usability, knowledge tracking fulfillment will be given greater importance when contributing knowledge compared to when seeking knowledge.*

2.3. Sociability

While usability is primarily concerned with users' interactions with a technology (i.e., human-computer interaction) (Löwgren, 2002), sociability is related to interactions among community members through the supporting technology (i.e., human-human interaction) (Preece, 2001). Sociability refers to characteristics of an online community system that support "a state of being sociable" (Merriam-Webster Dictionary), where members find it pleasant to interact with each other in attaining community-shared purposes through the technology-enabled space (Preece, 2001). It is akin to the concept of sociality (Bouman et al., 2007) in online social networks that focuses on how actors relate to each other to organize their social practices and construe their identities, with the common purpose (e.g., knowledge sharing) being highlighted in sociability.

An online community with high sociability is characterized by the presence of a conducive virtual environment for social interaction and governance of members' interactions based on a set of policies and rules for the attainment of community-shared purposes (i.e., knowledge sharing in our study) (Preece, 2000). Sociability is particularly important for knowledge sharing communities due to the need to have a technology-enabled environment in which members feel comfortable to share knowledge and learn from each other. It is also necessary to maintain a coherent focus in members' interaction within the intended knowledge domain. The latter is important because a community in

which members' interactions get derailed from the intended purposes (e.g., members recurrently talk about politics instead of sharing intended knowledge on computing) would cause confusion and eventually drive people away (Preece, 2000). Based on the reasoning above, we hypothesize that an online community with high perceived sociability will promote knowledge seeking as well as contribution:

H3a: Perceived sociability is positively related to knowledge seeking.
H3b: Perceived sociability is positively related to knowledge contribution.

Two major themes can be identified from the conceptualization of sociability: 1) the nature of members' interaction through the technology-enabled space; and 2) the governance of members' interaction in accordance with community policies and rules (Lazar and Preece, 2002; Maloney-Krichmar and Preece, 2005). The two themes correspond to the horizontal and vertical aspects of sociability in an online community. The former concerns the horizontal interaction among community members, whereas the latter is related to the vertical governance of members' interaction for the attainment of shared purposes. For the first theme, the *social interactivity* concept may capture the horizontal interaction among members. Social interactivity implies that individuals feel at ease and comfortable to engage in interpersonal communication exchanges through the technology-enabled space (Hoffman and Novak, 1996; Preece, 2000).

For the second theme, the *perception of moderator* concept can cater to the governance aspect of online communities (Lazar and Preece, 2002). Prior research has emphasized the need to enforce clear community policies and rules to guide members so that they understand what to expect and how to behave when interacting with others (Preece, 2000, 2001). Key to this governance is appropriate moderation that should be appreciated by community members (Maloney-Krichmar et al., 2002). Moderators are individuals assigned with the primary responsibility to govern interaction in an online community in accordance with a set of community policies and rules (Lazar and Preece, 2002; Preece, 2000). The presence of moderators is common in online knowledge sharing communities to support learning (Stanoevska-Slabeva and Schmid, 2001), and has been found to play a critical role in sustaining such communities (Gray, 2004). However, moderators require acceptance from community members to be effective. Lazar and Preece (2002) state: "Community rules are usually enforced by moderator… If these rules are unenforced, they are worthless" (p. 25). Further, moderators' enforcement of policies and rules should be accepted by members, as "the success of moderators [in gov erning interactions] is based on the opinions of community members" (p. 28-29).

Based on the above discussion, we identify two corresponding dimensions of sociability, i.e., social interactivity and perception of moderator, and compare how individuals may weigh these dimensions when seeking knowledge vs. contributing knowledge.

Social Interactivity

Social interactivity in an online community implies that individuals feel at ease and comfortable to engage in interpersonal communication exchanges through the technology-enabled space (Hoffman and Novak, 1996; Preece, 2000). This is similar to the notion of "person-interactivity" in the marketing literature, which is defined as the interactivity between people that occurs through a medium (Hoffman and Novak, 1996). Features of a discussion forum system for member communication, e.g., message posting and email, should help to improve the interactivity perception of individuals. We expect social interactivity to be given a higher weight in evaluating sociability when individuals contribute knowledge compared to when they seek knowledge.

Prior research has identified the desire for social interaction as a key driver behind individuals' willingness to contribute knowledge in online communities (Wasko and Faraj, 2000). While the ability to track knowledge in a community provides a basis for knowledge contributors to obtain incentives such as enhanced reputation, social interactivity provides a different form of incentive to contributors, i. e., the opportunity to interact and network with other knowledgeable members (Wasko and Faraj, 2000). A community space with high social interactivity makes it easy for knowledge contributors to take part in intellectual discourses with other community members. Such exposure to other knowledgeable members may lead them to refine their expertise and consequently harness their

knowledge. The incentive from social interactivity could also be in the form of enjoyment in interacting with others (Tedjamulia et al., 2005). Using the social exchange theory to understand knowledge sharing (Kankanhalli et al., 2005a; Wasko and Faraj, 2005), incentives such as these may help a knowledge contributor to justify the time and effort invested in contributing knowledge.

As far as knowledge seeking is concerned, the opportunity for interaction and other incentives derived from it (e.g., enjoyment) may be seen as lesser incentives compared to the utility of the knowledge sought for problem solving. Thus unlike knowledge contributors who can obtain some benefits in return for the expenditure of time and effort in social interactivity, this dimension is likely to be less salient to knowledge seekers. Accordingly, we hypothesize:

H4a: In evaluating sociability, social interactivity will be given greater importance when contributing knowledge compared to when seeking knowledge.

Perception of Moderator

Moderators are individuals whose primary role is to ensure that community members' interaction adheres to a set of policies and rules (Hummel and Lechner, 2002; Lazar and Preece, 2002). For instance, moderators may remove irrelevant postings, stop inappropriate behaviors in the community (e.g., flaming), guide a discussion that is going "off topic" back to the original focus, and suspend membership of individuals who commit a breach of community policies and rules.

In online communities for knowledge sharing, a moderator plays a key role in ensuring that members' postings are relevant to the target knowledge domain, and that interaction among community members is civil and adheres to community policies and rules (e.g., no advertising, no flaming). However, the governance role played by a moderator needs to be exercised with care such that it is well received by members (Lazar and Preece, 2002). If community members perceive the governance role performed by a moderator favorably, their sociability evaluation of the community is likely to improve. Conversely, if a moderator is perceived as being too stringent or lax, he or she may cause frustration and harm members' perceptions of the community sociability. Overall, members' perceptions of the moderator reflect the perceived effectiveness of the moderator in governing social interaction in the community.

A favorable perception of the moderator is expected to enhance the sociability evaluation in an online community when individuals seek knowledge more so than when they contribute knowledge. The major concern of individuals seeking knowledge is whether the knowledge obtained from the community is relevant for their problem solving (Kankanhalli et al., 2005b). A moderator who helps ensure that postings by members are within the intended knowledge domain can enhance the relevance of knowledge in the community (Hummel and Lechner, 2002). The governance of social interaction by a moderator, e.g., in stopping inappropriate postings and flaming (Abras, 2003; Preece, 2000), may also help prevent members from being overwhelmed by irrelevant postings or noise, and aid in the production of more useful knowledge in the community. Further, moderators can help knowledge seekers to locate the knowledge needed, either by referring them to the right experts or highlighting the specific postings containing the knowledge.

Knowledge contributors are also likely to appreciate a pleasant environment for knowledge sharing resulting from effective moderation and feel encouraged if requested by moderators to contribute knowledge (Kankanhalli et al., 2005s; Lin et al., 2005). However, value theory suggests that the moderator's role may be relatively less critical for knowledge contributors in evaluating sociability compared to knowledge seekers who rely on effective moderation to address the key need to obtain relevant knowledge for problem solving. Hence, we hypothesize:

H4b: In evaluating sociability, the perception of the moderator will be given greater importance when seeking knowledge compared to when contributing knowledge.

3. Research Methodology

We tested the research model using survey data collected from two different questionnaires. One focused on knowledge seeking and the other on knowledge contribution in an online community

(discussion forum) system employed at the computing faculty of a large public university to facilitate coursework discussion. Discussion forum systems have been widely employed in academic institutions to promote mutual learning among students (Luppicini, 2007), where active knowledge sharing (both seeking and contribution) is essential.

3.1. Construct Operationalization

The survey items were generated based on a review of the relevant information systems (IS), online community, knowledge management, and HCI literatures. Where previously tested measures were not available, we developed items based on the construct definition and description. As we are interested in studying how the different dimensions are weighted in the evaluation of usability and sociability when individuals seek knowledge compared to when they contribute knowledge, all constructs in this study were measured as perceptions of the respondents. Since the study employs several new measures, we conducted a thorough instrument validation as per procedures given in Moore and Benbasat (1991). We measured all items using a 7-point Likert scale (1 = strongly disagree; 7 = strongly agree), unless otherwise indicated. Table 1 summarizes the survey items.

Table 1: Operationalization of Constructs

Construct	Items	Source
Knowledge Seeking/ Contribution (KNO)	Frequently use the system to seek/contribute knowledge (KNO1)	Adapted from Davis (1989)
	Regularly use the system to seek/contribute knowledge (KNO2)	
	Use the system to seek/contribute knowledge *[several times a day/several times a week/several times a month/once in a few months]* (KNO3)	
Ease of Use (EAS)	Easy to understand how the system operates (EAS1)	Hornbæk, (2006), Preece (2000), Taylor and Todd (1995)
	Easy to understand how to use the system (EAS2)	
	Easy to learn how to use the system (EAS3)	
	Easy to learn the working of the system (EAS4)	
System Reliability (REL)	The system is stable (REL1)	Self-developed based on description in Palmer (2002)
	The system is robust enough for my use (REL2)	
	The system is always available (REL3)	
Knowledge Tracking Fulfillment (TRA)	Allows keeping track of my knowledge activities (TRA1)	Self-developed based on Goodman and Darr (1998)
	Allows keeping track of knowledge activities of others (TRA2)	
	Allows keeping track of all knowledge activities (TRA3)	
Social Interactivity (INT)	Conducive to interact with others through the system (INT1)	Self-developed based on Preece (2000)
	Easy to interact with others through the system (INT2)	
Perception of Moderator (MOD)	Feel at ease with the role of moderator (MOD1)	Self-developed
	Encouraged by moderator's presence (MOD2)	

Note: System in the items above refers to the online community system (discussion forum) that is provided as part of the university's courseware system.

3.2. Data Collection

The discussion forum system in this study is widely used by undergraduate students taking modules offered at the computing faculty to interact and exchange knowledge pertaining to computing on a voluntary basis. Individuals may post their questions related to computing concepts in the community and contribute answers to the questions asked by others as well as share knowledge they consider

beneficial to others, such as a newest computing trend or concept. There were an estimated[2] 130 participants who engaged in contributing knowledge (with an average of 4.97 postings per person) and 274 participants who engaged in seeking knowledge in the community system. The daily average was approximately 4.2 postings in the community, of which 3.0 were knowledge contributions and 1.2 were knowledge seeking questions (we did not count postings of primarily social nature such as "Hi" and "Thank you").

The discussion forum system is usually stable and available except during scheduled maintenance times, i.e., one hour per week at midnight. Content inside the system is organized in a tree-like structure, with indented replies organized under a discussion topic. Features provided by the system that help in participants' knowledge tracking include the records of a poster's name and date/time of each posting, responses received for each posting, and all postings made by each poster. Apart from the message posting function, the system allows members to e-mail each other. The search function is another highly used feature of the community system. It allows members to search using keywords or phrases within the posting content or topic title. They may also restrict the search within certain time periods by author or topic. The primary role of the moderator in these forums is to ensure the relevance of members' postings to the purposes and policies of the community. Inappropriate postings, e.g., flaming, are removed by the moderator from time to time.

We developed two separate sets of survey questionnaires, one for eliciting responses about knowledge seeking and the other for eliciting responses about knowledge contribution. To minimize confusion, we administered the questionnaires to two different groups of respondents, one questionnaire for those who engaged primarily in knowledge seeking and the other questionnaire for those who engaged primarily in knowledge contribution. We checked the activities performed by the respondents in the forum before administering the survey questionnaire. The administration of the two separate questionnaires (focusing on seeking and contribution respectively in their items) to specific groups of respondents also helped to prepare the respondents in anticipating the survey questions from the perspective of knowledge seeking or knowledge contribution. Participation in both surveys was voluntary, but a token payment was given for participation.

Students in a large computing course were invited to participate in the survey. The majority of the students had little or no prior knowledge of the topics introduced in the computing course. Of the 385 students invited, 235 usable responses were received, with 120 from the knowledge seeking perspective and the remaining 115 from the knowledge contribution perspective. Table 2 shows the respondents' demographic information. The proportions of male and female respondents were about the same for both the knowledge seeking and knowledge contribution samples (54.2 percent are males and 45.8 percent are females for knowledge seeking; 57.4 percent are males and 42.6 percent are females for knowledge contribution), with the majority of the respondents aged between 20-25 years old (92.5 percent for knowledge seeking and 96.5 percent for knowledge contribution). On aver age, the respondents had 2.56 and 2.40 years of experience with the community system for the knowl edge seeking and knowledge contribution samples, respectively.

Table 2: Demographic Information of Respondents

		For Knowledge Seeking		For Knowledge Contributing	
		Freq. (n=120)	**Percent (%)**	**Freq. (n=115)**	**Percent (%)**
Gender	**Male**	65	54.2	66	57.4
	Female	55	45.8	49	42.6
Age	**<20**	5	4.2	2	1.7
	20-25	111	92.5	111	96.5
	>25	4	3.3	2	1.8
Experience with the discussi on forum system		Mean = 2.56 Stand. Deviation (S. D.) = 1.10		Mean = 2.40 Stand. Deviation (S. D.) = 1.19	

[2] A precise figure is not possible to obtain due to the dynamic nature of participation in the community, where participants may join and leave the community at any time. The figures were estimated based on postings in the forum.

4. Data Analysis and Results

Prior to assessing the structural model of Figure 1, we tested the measurement model and evaluated measurement invariance. As the survey questionnaire was administered to two groups of respondents, i.e., one for knowledge seeking and another for knowledge contribution, it is important to establish measurement invariance prior to comparing responses from the two groups (Cheung and Rensvold, 2002; Hong et al., 2003). Measurement invariance implies that the results concerning between-group differences are due to true attitudinal differences, rather than differences in the psychometric properties of the measures (the measurement items used for comparison mean the same to the respondents answering the questionnaire for knowledge seeking and that for knowledge contribution).

For testing measurement invariance, we used LISREL v8.80 to perform confirmatory factor analyses of the models for knowledge seeking and contribution. Confirmatory factor analyses provide a rigorous assessment of the fit between the collected data and the theoretical factor structure (Bagozzi, 1980). LISREL also provides the capability for multi-group analyses that are needed to evaluate measurement invariance. For the test of the measurement model and structural model, we used Partial Least Square (PLS), because it allows for the modeling of both reflective and formative constructs (Fornell, 1982). LISREL is not considered appropriate in modeling the formative constructs (usability and sociability) that are present in our model (Chin, 1998; Fornell and Bookstein, 1982). Reflective indicators represent an unmeasured latent construct deemed to exist before it is measured and are invoked to account for the observed variances and covariances in the construct. Formative indicators form a super-ordinate construct where the individual indicators/dimensions are weighted according to their relative importance in forming the construct (Law et al., 1998).

In this study, we model usability and sociability as formative constructs, since both of these constructs are the primary focus of this study, and doing so allows us to better describe, investigate, and measure the constructs (Petter et al., 2007). Specifically, the formative construct usability consists of three dimensions, namely, ease of use, reliability, and knowledge tracking fulfillment. Sociability consists of the dimensions of social interactivity and perception of the moderator. Thus, both these constructs are second-order, multi-dimensional formative constructs with first-order reflective constructs as their dimensions. Such modeling of usability and sociability also fits the conditions for a formative construct (Jarvis et al., 2003), where (1) the different dimensions cause the respective constructs, rather than reflecting them; (2) the different dimensions are not interchangeable, i.e., they represent different themes (for instance, the ease of use and knowledge tracking fulfillment dimensions for usability); (3) a change in the value of one of the dimensions is not necessarily expected to be associated with a change in all of the other dimensions (for instance, a change in ease of use may not affect knowledge tracking fulfillment); and (4) the antecedents and consequences of the different dimensions are likely to be different (for instance, a system perceived to be easy to use may be attributed to a simple and intuitive interface, but a system perceived to be high in knowledge tracking fulfillment is likely to be facilitated by comprehensive functionalities to archive members' exchanges for tracking).

4.1. Measurement Model Analysis and Measurement Invariance Test

The strength of the measurement model can be demonstrated by convergent and discriminant validity tests for the reflective constructs (Hair et al., 1998), i.e., items of the same construct being similar and dissimilar from items of other constructs. All reflective constructs (all constructs except usability and sociability) in our model exhibited acceptable levels of convergent validity (Table 3) and discriminant validity (Tables 4 and 5).

After the validation of the measurement model, we performed invariance analyses. Invariance tests indicate that any differences observed between the different groups of respondents can be attributed to true attitudinal differences. We tested three required hierarchical levels of invariance, i.e., configural, metric, and scalar (Steenkamp and Baumgartner, 1998).

Table 3: Convergent Validity of Reflective Constructs (Seeking | Contribution)							
Construct	**Stand. Param. Est.**	**t-value**	**Mean**	**S.D.**	**CA**	**CR**	**AVE**
Knowledge Seeking/Contribution (KNO)					0.82 | 0.79	0.90 | 0.90	0.75 | 0.74
KNO1	0.95 | 0.92	89.62 | 45.40	4.74 | 4.31	1.22 | 1.27			
KNO2	0.92 | 0.91	47.24 | 36.11	4.84 | 4.46	1.21 | 1.29			
KNO3	0.70 | 0.76	8.62 | 12.84	4.25 | 3.96	1.42 | 1.84			
Ease of Use (EAS)					0.92 | 0.92	0.94 | 0.95	0.80 | 0.81
EAS1	0.86 | 0.89	20.75 | 33.90	5.23 | 5.21	1.07 | 1.14			
EAS2	0.91 | 0.87	33.86 | 32.54	5.24 | 5.28	1.07 | 1.03			
EAS3	0.91 | 0.91	36.18 | 44.52	5.35 | 5.24	1.10 | 1.19			
EAS4	0.91 | 0.93	35.08 | 74.19	5.15 | 5.27	1.19 | 1.12			
System Reliability (REL)					0.81 | 0.76	0.89 | 0.86	0.72 | 0.68
REL1	0.85 | 0.87	18.13 | 26.57	5.28 | 5.23	1.10 | 1.20			
REL2	0.88 | 0.87	35.60 | 23.63	5.05 | 4.90	1.14 | 1.23			
REL3	0.80 | 0.72	17.38 | 8.18	5.16 | 5.29	1.24 | 1.23			
Knowledge Tracking Fulfillment (TRA)					0.85 | 0.89	0.91 | 0.93	0.77 | 0.82
TRA1	0.87 | 0.92	11.56 | 43.62	4.27 | 4.65	1.28 | 1.27			
TRA2	0.92 | 0.93	32.73 | 64.22	4.19 | 4.77	1.33 | 1.22			
TRA3	0.82 | 0.87	12.51 | 26.43	4.38 | 4.61	1.21 | 1.33			
Social Interactivity (INT)					0.77 | 0.82	0.90 | 0.92	0.82 | 0.85
INT1	0.90 | 0.93	36.39 | 65.16	4.99 | 4.91	1.20 | 1.24			
INT2	0.91 | 0.92	44.99 | 53.89	5.03 | 5.03	1.05 | 1.20			
Perception of Moderator (MOD)					0.77 | 0.85	0.90 | 0.93	0.82 | 0.88
MOD1	0.90 | 0.95	43.46 | 21.36	5.08 | 5.08	1.04 | 1.00			
MOD2	0.91 | 0.89	47.85 | 7.14	4.93 | 4.87	1.19 | 1.20			

Acceptable Thresholds:
Cronbach's Alpha (CA) > 0.7, Composite Reliability (CR) > 0.7, Average Variance Extracted (AVE) > 0.5 (Fornell and Larcker, 1981; Nunnally, 1978)

Table 4: Results of Factor Analysis (Seeking | Contribution)

	1	2	3	4	5	6
KNO1	0.23 | 0.18	0.03 | 0.09	0.22 | 0.08	**0.85 | 0.87**	0.13 | 0.09	0.15 | 0.16
KNO2	0.27 | 0.24	0.13 | 0.15	0.28 | 0.09	**0.79 | 0.84**	0.18 | 0.11	0.05 | 0.11
KNO3	0.04 | 0.06	-0.02 | -0.04	-0.04 | 0.06	**0.82 | 0.74**	-0.05 | -0.10	0.09 | 0.23
EAS1	**0.87 | 0.85**	0.09 | 0.15	0.10 | 0.16	0.11 | 0.14	0.11 | 0.08	-0.04 | 0.07
EAS2	**0.87 | 0.85**	0.21 | 0.03	0.14 | 0.02	0.16 | 0.20	-0.03 | 0.19	0.05 | 0.08
EAS3	**0.85 | 0.87**	0.03 | 0.22	0.21 | 0.10	0.10 | 0.5	0.01 | 0.03	0.26 | 0.14
EAS4	**0.85 | 0.88**	0.14 | 0.19	0.15 | 0.07	0.16 | 0.16	0.02 | 0.06	0.19 | 0.10
REL1	0.15 | 0.09	0.08 | 0.09	**0.82 | 0.91**	0.10 | 0.05	0.16 | 0.04	-0.04 | 0.06
REL2	0.22 | 0.22	-0.00 | 0.09	**0.80 | 0.70**	0.21 | 0.01	0.05 | 0.32	0.12 | 0.27
REL3	0.12 | 0.04	-0.04 | 0.07	**0.82 | 0.72**	0.03 | 0.16	0.05 | 0.21	0.16 | -0.06
TRA1	0.11 | 0.27	**0.85 | 0.85**	0.05 | 0.06	-0.04 | 0.10	-0.01 | 0.10	0.18 | 0.12
TRA2	0.15 | 0.36	**0.90 | 0.84**	0.06 | 0.02	0.03 | 0.06	-0.03 | 0.08	-0.01 | 0.14
TRA3	0.09 | -0.01	**0.85 | 0.92**	-0.07 | 0.17	0.11 | 0.04	-0.00 | 0.11	-0.02 | 0.05
INT1	0.13 | 0.08	0.10 | 0.18	0.06 | 0.13	0.28 | 0.31	0.11 | 0.07	**0.84 | 0.83**
INT2	0.19 | 0.21	0.05 | 0.10	0.17 | 0.04	0.01 | 0.21	0.23 | 0.04	**0.85 | 0.87**
MOD1	-0.06 | 0.20	-0.03 | 0.16	0.19 | 0.21	0.01 | 0.01	**0.86 | 0.86**	0.19 | 0.19
MOD2	0.13 | 0.08	-0.02 | 0.10	0.04 | 0.24	0.14 | 0.06	**0.89 | 0.91**	0.12 | -0.07
Eigenvalue	5.43 | 5.97	2.42 | 2.16	1.74 | 1.95	1.53 | 1.66	1.41 | 1.02	1.03 | 1.02
Variance explained (%)	31.93 | 35.12	14.22 | 12.73	10.22 | 11.49	9.02 | 9.74	8.27 | 6.02	6.04 | 6.00
Cumulative variance (%)	31.93 | 35.12	46.15 | 47.85	56.36 | 59.34	65.38 | 69.08	73.65 | 75.10	79.70 | 81.10

Loadings of all items on their constructs are above the minimum recommended level of 0.5 (Hair et al., 1998).

Table 5: Correlations between Constructs (Seeking | Contributing)

	KNO	EAS	REL	TRA	INT	MOD
KNO	**0.87 | 0.86**					
EAS	0.42 | 0.37	**0.89 | 0.90**				
REL	0.38 | 0.24	0.39 | 0.30	**0.85 | 0.82**			
TRA	0.14 | 0.23	0.28 | 0.44	0.07 | 0.25	**0.88 | 0.91**		
INT	0.34 | 0.49	0.34 | 0.34	0.28 | 0.28	0.16 | 0.32	**0.91 | 0.92**	
MOD	0.24 | 0.15	0.12 | 0.30	0.26 | 0.49	-0.02 | 0.30	0.37 | 0.21	**0.91 | 0.94**

Each diagonal element – which is the square root of the average variance extracted for the respective construct – exceeds all the correlations in the corresponding row and column (Fornell and Larcker, 1981)

The configural invariance test examines if both groups (i.e., respondents for the knowledge seeking questionnaire and the knowledge contribution questionnaire) use the same pattern in assessing the items. *Metric invariance* postulates that all factor loadings are equal across groups (Cheung and Rensvold, 2002). *Scalar invariance* holds that all measurement items indicate the same across-group differences. Our test results (Table A1 in Appendix A) show that configural invariance and metric invariance conditions are satisfied, while scalar invariance is largely supported (details of the three measurement invariance levels and tests are provided in Appendix A). Due to the partial scalar invariance, we adopted a more stringent requirement in testing the between-group differences by employing a p-value of $\leq$0.0001.

4.2. Structural Model Analysis

With measurement invariance largely established, the proposed hypotheses were tested using PLS. For testing of the hypotheses involving the differences between knowledge seeking and knowledge contribution (H2a, H2b, H2c, H4a, and H4b), we statistically compared the corresponding path coefficients in the structural models of the two groups using the procedure employed by Keil et al. (2000). A significant t-value as computed below indicates significant between-group difference for the particular path.

$$S_{pooled} = \sqrt{\{[(N_1 - 1)/(N_1 + N_2 - 2)] \times SE_1^2 + [(N_2 - 1)/(N_1 + N_2 - 2)] \times SE_2^2\}}$$
$$t = (PC_1 - PC_2) / [S_{pooled} \times \sqrt{(1/N_1 + 1/N_2)}]$$

Where S_{pooled} *= pooled estimator for the variance*
t *= t-statistic with* $(N_1 + N_2 - 2)$ *degrees of freedom*
N_i *= sample size of dataset for group* i
SE_i *= standard error of path in structural model of group* i
PC_i *= path coefficient in structural model of group* i

The results (see Table 6) show that all comparison hypotheses (H2a, H2b, H2c, H4a, and H4b) were supported. Individuals placed significantly greater importance on *ease of use* and *reliability* in evaluating *usability*, and on *perception of moderator* in evaluating *sociability* when they seek knowledge (H2a, H2b, and H4b supported). *Knowledge tracking fulfillment* and *social interactivity* were given significantly greater importance in evaluating *usability* and *sociability,* respectively, when individuals contribute knowledge (H2c and H4a supported). For the hypotheses common to knowledge seeking and contribution, the results (see Table 7) show that usability and sociability were significant predictors of both knowledge seeking and knowledge contribution in the online community (H1a, H1b, H3a, and H3b were supported).

Table 6: Tests of Differences between Knowledge Seeking and Contribution

		H2a	H2b	H2c	H4a	H4b
Path coefficient (Standard error)	**S**	0.72 (0.05)	0.35 (0.05)	0.22 (0.09)	0.63 (0.04)	0.58 (0.04)
	C	0.65 (0.05)	0.24 (0.05)	0.38 (0.04)	0.75 (0.09)	0.50 (0.12)
t-test across groups (df.)		**10.73**** (233)	**16.86**** (233)	**-17.48**** (233)	**-13.30**** (233)	**6.91**** (233)

S – Knowledge seeking; C – Knowledge contribution; ****: $p \leq 0.0001$

Table 7: Results of Hypotheses Testing

Hypothesis	**Coefficient**		**t-value**		**Outcome**	
	Seeking	Contribution	Seeking	Contribution	Seeking	Contribution
H1a,b USA →KNO	0.41	0.27	4.28***	3.03**	**Supported**	**Supported**
H3a,b SOC→ KNO	0.16	0.31	1.81*	3.06**	**Supported**	**Supported**
H2a EAS→USA	0.72	0.65	13.18***	13.59***	**Supported**	
H2b REL→ USA	0.35	0.24	6.79***	4.75***	**Supported**	
H2c TRA→USA	0.22	0.38	2.84**	9.72***	**Supported**	
H4a INT → SOC	0.63	0.75	15.72***	7.93***	**Supported**	
H4b MOD → SOC	0.58	0.50	15.06***	4.42***	**Supported**	

USA – Perceived Usability; SOC – Perceived Sociability (*: $p \leq 0.05$; **: $p \leq 0.01$; ***: $p \leq 0.001$)

Further, the results are robust after controlling for age, gender, and experience of using the discussion forum system. None of these control variables was significant for the knowledge seeking model. However, age, gender, and experience significantly influence individual's use of the system to contribute knowledge. Specifically, males and individuals who had more experience in using the system were more likely to contribute knowledge, whereas older individuals were less likely to do so. The resultant R^2 for the knowledge seeking model is 0.300, whereas the R^2 for the knowledge contribution model is 0.302, indicating sufficient explanatory power for both models (Hair et al., 1998).

We also performed post-hoc analysis to check for the presence of common method variance, which is a potential threat to research using surveys that collect responses in a single setting. Specifically, Harman's (1967) one-factor test that is widely employed for this purpose (e.g., Krishnan et al., 2006; Steensma et al., 2005) was conducted. According to this test, the potential for common method variance is high if a single factor can account for a majority of covariance (more than 50 percent) in the independent and dependent variables (Harman, 1967; Mattila and Enz, 2002). The results of an un-rotated principal components factor analysis showed that the threat of common method variance is not evident in our study (the largest factor accounts for 35.12 percent of the variance explained, which is less than 50 percent).

5. Discussion and Conclusion

This study's objective was to develop a comparative theoretical model to understand the differences in the evaluation of usability and sociability for knowledge seeking as compared to knowledge contribution in an online community forum. Specifically, the following question was examined: Do individuals place different importance on various dimensions of perceived usability and sociability when seeking knowledge, compared to contributing knowledge? We now discuss the results, focusing first on usability and then on sociability.

Consistent with prior studies (e.g., Lecerof and Paterno, 1998, Nielsen, 2000), our research highlights and extends the significance of usability to knowledge seeking and knowledge contribution in online communities. Furthermore, our study contributes to existing literature by revealing the significant differences in how the different dimensions of usability are weighted by individuals when seeking knowledge compared to when contributing knowledge. Specifically, in evaluating usability in an online community, individuals place significantly greater importance on ease of use and system reliability when they seek knowledge, whereas knowledge tracking fulfillment is perceived to be more important when individuals contribute knowledge.

Our results also provide further support for the importance of sociability (which is a relatively new construct compared to usability) in influencing participation in online communities (Preece, 2000). Further, the importance of sociability applies to both knowledge seeking and knowledge contribution activities. Additionally, significant differences were highlighted in how individuals evaluate the different dimensions of sociability when they seek knowledge compared to when they contribute knowledge. As hypothesized, individuals place higher importance on social interactivity in sociability evaluation when contributing knowledge compared to seeking knowledge. On the other hand, perception of the moderator is given a greater importance in evaluating sociability when individuals seek knowledge compared to when they contribute knowledge.

5.1. Theoretical Implications

This study advances our understanding about knowledge sharing in online communities by developing a comparative theoretical model for systematic comparison between knowledge seeking and knowledge contribution activities. Building on the socio-technical perspective, the theoretical model incorporates the component dimensions of the relatively less studied usability and sociability perceptions in an online community (Preece, 2000; Maloney-Krichmar and Preece, 2005). Our findings provide support for the importance of these two constructs in knowledge seeking and contribution, in addition to individuals' motivational factors that have been widely investigated in previous literature. The theoretically-grounded research also advances existing work that investigates participation in online communities supporting mutual learning (e.g., Barab et al., 2001; Bruckman,

2002; Charalambos et al., 2004; Gray, 2001; Jones and Preece, 2006; Tolmie and Boyle, 2000) by quantitatively validating usability and sociability as explained below.

While prior research has relied on ethnographic or case study methods to assess the two concepts in online communities (e.g., Alem and Kravis, 2005; Barab et al., 2001; Maloney-Krichmar and Preece, 2005; Wright and Street, 2007), we extend this line of work by quantitatively assessing these constructs and statistically testing their relationships with knowledge seeking and contribution in online communities. Our study adopted established procedures (Moore and Benbasat, 1991) to operationalize usability and sociability, resulting in valid survey instruments for these constructs.

Further, the study underscores the differences in how individuals perceive the importance of the various dimensions of usability and sociability when seeking knowledge compared to contributing knowledge. By highlighting such differences, the study demonstrates the value of devoting specific research attention to the needs of the two knowledge sharing activities (knowledge seeking and knowledge contribution). While previous studies (e.g., Bock et al. 2005; Kankanhalli et al., 2005a, 2005b; Ma and Agarwal, 2007; Wasko and Faraj, 2000, 2005; Zhang and Watts, 2003) have separately focused on either knowledge seeking or knowledge contribution, the current study extends existing literature by systematically comparing the two with respect to knowledge sharing in online communities. With respect to this comparison, the study illustrates the use of measurement invariance tests when there is a need to perform reliable comparison between different groups of subjects (Cheung and Rensvold, 2002). It underlines the importance of establishing measurement invariance to ensure that any between-group differences that are found are due to true attitudinal differences (rather than differences in how the respondents from different groups interpreted the measurement items).

Additional insights can also be obtained from separately examining the research models for knowledge seeking and knowledge contribution (Figures 2 and 3, respectively). While our results show that both models (for seeking and contribution) using usability and sociability as antecedents offer similar explanatory power (0.300 and 0.302, respectively), a separate examination of the models shows that the two antecedents as well as their underlying dimensions have different relative significance for individuals in performing the particular knowledge sharing activity.

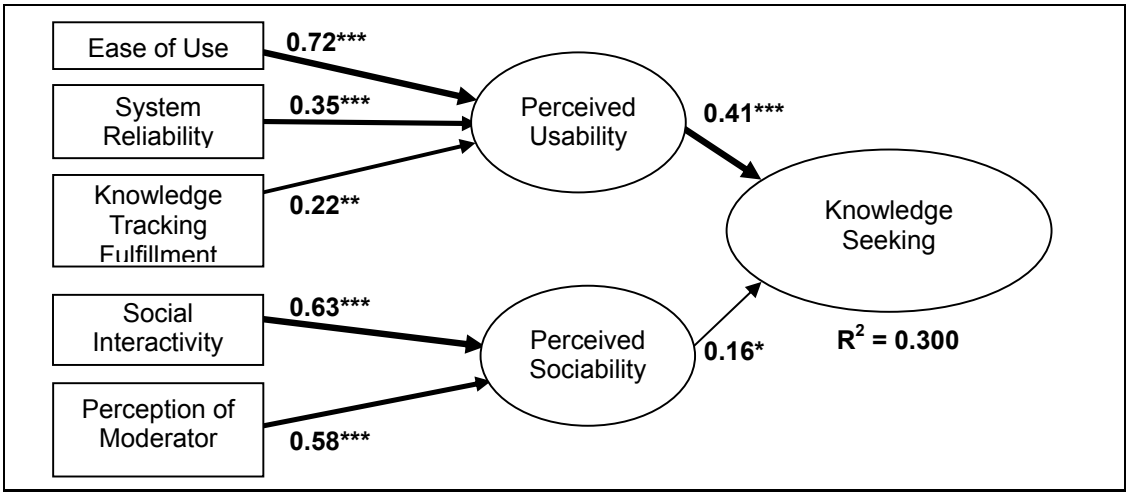

Figure 2. Results of Hypotheses Testing for the Knowledge Seeking Model (Relationships of higher significance are depicted by thicker arrows)

For individuals seeking knowledge (Figure 2), perceived usability seems to have a clearly stronger effect than perceived sociability on their knowledge seeking. This implies that when individuals need to obtain knowledge for problem solving, they are more concerned about whether the community system can be used easily and effectively to seek knowledge, more so than whether the community

environment is conducive for social interaction. In evaluating the usability of the community system, ease of use is given the highest relative importance, followed by system reliability, and then knowledge tracking fulfillment. For sociability, social interactivity and perception of the moderator are given approximately equal importance. Thus, while previous research has suggested that usability and sociability are important participation antecedents in online communities (Preece 2000, 2001; Maloney-Krichmar and Preece, 2005), our study offers a better understanding of the effects of these constructs and their underlying dimensions by explicating their relative significance for seeking knowledge in the online community context.

When contributing knowledge (Figure 3), individuals seem to perceive both usability and sociability as having roughly equal importance, with sociability being slightly more significant. In evaluating usability of the community system, ease of use is given the highest importance, followed by knowledge tracking fulfillment, and then system reliability. In evaluating sociability, social interactivity is perceived to be more important than perception of the moderator. Apart from elucidating the relative significance of the usability and sociability constructs and their underlying dimensions for knowledge contribution, the results resonate with previous research that highlights the role of social factors in influencing knowledge contribution in addition to technology-related perceptions (e.g., Kankanhalli et al., 2005a; Valck et al., 2007; Wasko et al. 2004; Wasko and Faraj, 2005).

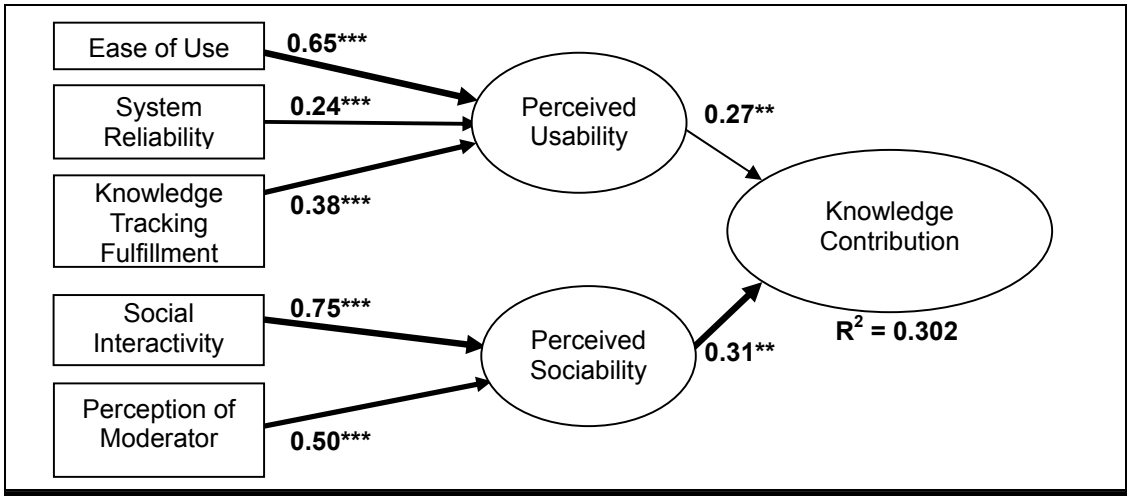

Figure 3. Results of Hypotheses Testing for the Knowledge Contribution Model (Relationships of higher significance are depicted by thicker arrows)

5.2. Practical Implications

Given the limited resources available to managers of online communities (both in terms of human and system resources) and the need to allocate these resources efficiently and effectively, our study has important implications for practice. By obtaining insights on how individuals may assign different importance to usability and sociability dimensions when seeking knowledge compared to contributing knowledge, managers will be able to manage individuals' perceptions more effectively to promote both knowledge sharing activities. This will allow for a better balance of knowledge seeking and contribution activities in a knowledge market and promote the sustainability of knowledge sharing (Davenport and Prusak, 1998; Dutta et al., 2007) in an online community. Depending on whether there is an imbalance in either the demand for (seeking) or supply of knowledge (contribution), managers of online communities may devise the appropriate interventions to attain a better balance, informed by our discussion below.

As individuals are more concerned about a system's ease of use when seeking knowledge compared to contributing knowledge, community managers should focus more time and effort on communicating to knowledge seekers that using the community system will be free of effort. Interventions that can

shape individuals' favorable ease of use perceptions can be made, such as providing the necessary support and resources for using the system to seek knowledge (Venkatesh, 2000). Efforts taken to improve the system to make it easier to seek knowledge, such as creating a simplified and more consistent interface (Shneiderman, 1998) and an enhanced search function (e.g., with provision of relevant fields and options to narrow down and refine searches), should be clearly communicated to seekers. However, this does not mean that community managers need not convince knowledge contributors about the ease of using the community system. It remains important to ensure that contributors perceive a threshold level of ease of use such that contributing knowledge through the system is not considered too effort-laden, even though it may not need to be emphasized as much.

As individuals place significantly greater importance on system reliability when seeking knowledge compared to contributing knowledge, it is particularly important to impress on them that the system is stable, robust, and available whenever it is needed. One way for managers to achieve this is by providing service guarantees that disruption to knowledge seeking activities will be kept minimal. For instance, daily system maintenance should only be conducted when the typical level of knowledge seeking activities is lowest. To shape seekers' favorable perceptions of system reliability, managers of online communities may also tune the server during periods of heavy traffic to provide relatively more resources for knowledge seeking activities, e.g., giving higher priority to search-related functions and processes. As discussed, this is because individuals are likely to have more time-critical needs to fulfill through the system when seeking knowledge compared to contributing knowledge.

Greater attention should be paid to the needs of contributors to track knowledge activities, since they are found to place greater importance on this usability dimension as compared to seekers. Thus, features that can facilitate knowledge tracking should be communicated adequately to individuals who are active in contributing knowledge in the community. Practical examples of knowledge tracking can be seen in Siemens' ShareNet, whereby "details of ShareNet members, including all their contributions and their level of usefulness, could be viewed by everyone on the system" (McCormack et al., 2002, p. 9). Guidance should also be provided when necessary to contributors on the use of these features. Relating such features to previous research that found individuals' desire for reputation in contributing knowledge (Wasko and Faraj, 2005), cumulative statistics of contributions and an associated membership status or title (e.g., "senior member") can be displayed and communicated as a way to identify and recognize each knowledge contributor and increase the visibili ty of his/her contributions.

To enhance sociability, this study suggests a two-pronged approach to improving the perception of social interactivity and engaging experienced moderators who may be better received by members in enforcing community polices and rules. It is important for community managers to inform members of the available options that can facilitate communication exchanges for knowledge sharing, such as direct e-mailing and reply and quoting functions in posting, which allow a continuous flow of interaction to be easily visualized (Hoffman and Novak, 1996; Rafaeli and Sudweeks, 1997). This is especially important for individuals when contributing knowledge, since social interactivity is valued higher than when seeking knowledge, and they may view the interaction with others as a form of return for their contributions.

Through moderators, community policies and rules that are crafted to promote a favorable environment for knowledge sharing can be communicated to members from time to time. Specifically, for knowledge seekers who place greater importance on the perception of moderators than do contributors, moderators need to raise members' awareness of community policies and administer sanctions for inappropriate behavior (e.g., suspending the memberships of those who are involved in flaming), so as to cultivate a pleasant environment for knowledge seeking. Moderators may also help to match the knowledge needs of individual seekers to the right experts or the postings containing the knowledge required. Recruiting moderators with experience in community governance can aid this process.

5.3. Limitations and Future Work

The contributions of this study need to be interpreted in light of the following limitations. Specifically,

the study was conducted in the context of a knowledge sharing community in which mutual learning among the participants is the end objective. Some findings obtained from this context may not be generalizable to communities that serve other objectives. An instance is online communities created for the purpose of facilitating inter-firm knowledge exchange, such as in product design (Kraaijenbrink and Wijnhoven, 2008). Due to their nature, such communities typically have more pronounced hierarchies and purposes geared toward formal work objectives (de Souza and Preece, 2004). In these communities, seekers social interactivity perception may increase in importance, since the knowledge procurement process is likely to be complex and requires frequent interaction among the parties involved, such as the firms collaborating in joint product design.

There are also communities that practice a more stringent and restricted control on members' postings due to the need for accurate content, e.g., journalism and investing-related communities (e.g., Gu et al. 2007). The time-sensitive and developmental nature of the content in these communities (e.g., news development, stock price changes) may cause individuals who seek knowledge to value the ability to track knowledge activities more, which may minimize the differential between seekers and contributors in their emphasis on knowledge tracking fulfillment. Therefore, future studies may be conducted in these specialized communities to investigate the generalizability of our findings.

Additionally, our study was conducted in online communities in which moderation is considered to be important for their success (Gray, 2004). Future research may be conducted in the context of communities that are un-moderated to investigate how sociability dimensions in these communities differ from the current context. Last, while our research provides useful guidance to community managers on how knowledge seeking and knowledge contribution can be simultaneously promoted, it does not spell out how a balanced state between the two knowledge sharing activities can be achieved. Future studies may investigate this important issue building on this work.

This study furthers our understanding of the differences in how individuals evaluate usability and sociability when seeking knowledge compared to when contributing knowledge in online communities. The findings can assist managers of online communities in devising more focused strategies to manage users' perceptions in order to promote both knowledge seeking and contribution activities that are vital for the success of online communities. Considering the increasing prevalence and value of online communities for knowledge sharing, studies of this nature can be useful for furthering research and practice in this area.

Acknowledgement

We would like to acknowledge that the research is supported by the following grant: R-253-000-063-646 (Singapore Ministry of Education)

References

Abras, C. (2003) "Determining Success in Online Education and Health Communities: Developing Usability and Sociability Heuristics," *Unpublished PhD thesis*, University of Maryland, Baltimore County, Baltimore, MD.

Alem, L. and S. Kravis (2005) "Design and Evaluation of an Online Learning Community: A Case Study at CSIRO," *ACM SIGGROUP Bulletin*, (25)1, pp. 20-24.

Bagozzi, R. P. (1980) *Causal Models in Marketing*. NY: John Wiley & Sons.

Barab, S. A., J. G. Makinster, J. A. Moore, D. J. Cunningham, and The ILF Design Team (2001) "Designing and Building an On-line Community: The Struggle to Support Sociability in the Inquiry Learning Forum," *Educational Technology Research and Development*, (49)4, pp. 71-96.

Blau, P. M. (1964) *Exchange and Power in Social Life*. NY: Wiley.

Bock, G. W., R. W. Zmud, and Y. G. Kim (2005) "Behavioral Intention Formation in Knowledge Sharing: Examining the Roles of Extrinsic Motivators, Social-psychological Forces, and Organizational Climate," *MIS Quarterly*, 29(1), pp. 87-111.

Bouman, W., T. Hoogenboom, R. Jansen, B. de Bruin, and A. Huizing (2007) "The Realm of Sociality: Notes on the Design of Social Software," in *Proceedings of the International Conference on Information Systems*, Montreal, Quebec, Canada.

Bruckman, A. (2002) "The Future of E-Learning Communities." *Communications of the ACM*, (45)4, pp. 60-63.

Butler, B. (2001) "Membership Size, Communication Activity, and Sustainability: A Resource-based Model of Online Social Structures," *Information Systems Research*, 12(4), pp. 346-362.

Charalambos, V., Michalinos, Z., and Chamberlain, E. (2004) "The Design of Online Learning Communities: Critical Issues," *Educational Media International*, (41)2, pp. 135-143.

Cheung, G. W. and R. B. Rensvold (2002) "Evaluating Goodness-of-fit Indexes for Testing Measurement Invariance," *Structural Equation Modeling,* (9)2, pp. 233-255.

Chin W. (1998) "Issues and Opinion on Structural Equation Modeling," *MIS Quarterly,* (22)1, pp. 7–16.

Davenport, T. H. and L. Prusak (1998) *Working Knowledge: How Organizations Manage What They Know*. Cambridge, MA: Harvard Business School Press.

Davis, F. D. (1989) "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology," *MIS Quarterly,* (13)3, pp. 319-341.

Davis, F. D., R. P. Bagozzi, and P. R. Warshaw (1989) "User Acceptance of Computer Technology: A Comparison of Two Theoretical Models," *Management Science,* (35)8, pp. 982-1003.

DeSanctis, G. and M. S. Poole (1994) "Capturing the Complexity in Advanced Technology Use: Adaptive Structuration Theory," *Organization Science,* (5)2, pp. 121-145.

De Souza, C.S., and J. Preece (2004) "A Framework for Analyzing and Understanding Online Communities," *Interacting with Computers, The Interdisciplinary Journal of Human-Computer Interaction, (*16)3, pp. 579-610.

Dutta, A., A. Kankanhalli and R. Roy (2007) "The Dynamics of Sustainability of Electronic Knowledge Repositories," *Proceedings of the 28th International Conference on Information Systems,* Montreal, Canada.

Fornell, C. (1982) *A Second Generation of Multivariate Analysis*. NY: Praeger.

Fornell, C. and F. L. Bookstein (1982) "Two Structural Equation Models: LISREL and PLS Applied to Consumer Exit-voice Theory," *Journal of Marketing Research,* (19)4 pp. 440-452.

Fornell, C. and D. Larcker (1981) "Evaluating Structural Equation Models with Unobservable Variables and Measurement Error," *Journal of Marketing Research,* (18)1, pp. 39-50.

Fulk, J., A. Flanagin, M. Kalman, P. R. Monge, and T. Ryan (1996) "Connective and Communal Public Goods in Interactive Communication Systems," *Communication Theory*, (6)1, pp. 60-87.

Goodman, P. S. and E. D. Darr (1998) "Computer-aided Systems and Communities: Mechanisms for Organizational Learning in Distributed Environments," *MIS Quarterly,* (22)4, pp. 417–440.

Gray, B. (2004) "Informal Learning in an Online Community of Practice," *Journal of Distance Education*, (19)1, pp. 20-35.

Griffith, T. (1999) "Technology Features as Triggers for Sensemaking," *Academy of Management Review* (24)3, pp. 472-488.

Gu, B., P. Konana, B. Rajagopalan, and H-W M Chen (2007) "Competition among Virtual Communities and User Valuation: The Case of Investing-related Communities," *Information Systems Research*, (18)1 pp. 68-85.

Hair, J. F., R. E. Anderson, R. L. Tatham, and W. C. Black (1998) *Multivariate Data Analysis with Readings* (5th ed.). NY: Macmillan.

Harman, H. H. (1967) *Modern Factor Analysis.* Chicago: University of Chicago Press.

Harper, F. A. (1974) *An Introduction to Value Theory*. Calif.: Institute for Humane Studies, Inc.

Hoffman, D. L. and T. P. Novak (1996) "Marketing in Hypermedia Computer-mediated Environments: Conceptual Foundations," *Journal of Marketing,* (60)3, pp. 50–68.

Holzinger, A. (2005) "Usability Engineering Methods for Software Developers," *Communications of the ACM*, (48)1, pp. 71-74.

Hong, S., M. Malik, and M. Lee (2003) "Testing Configural, Metric, Scalar, and Latent Mean Invariance across Genders in Sociotropy and Autonomy using Non-Western Sample," *Educational and Psychological Measurement,* (63)4, pp. 636-654.

Hornbæk, K. (2006) "Current Practice in Measuring Usability: Challenges to Usability Studies and Research," *International Journal of Human-Computer Studies,* (64)2, pp. 79-102.

Hummel, J. and U. Lechner (2002) "Social Profiles of Virtual Communities," *Proceedings of the 35th HICSS*, Big Island, Hawaii. IEEE, pp. 2245-2254.
Jarvenpaa, S. L. and D. S. Staples (2001) "Exploring Perceptions of Organizational Ownership of Information and Expertise," *Journal of MIS,* (18)1, pp. 151-183.
Jarvis, C. B., S. B. MacKenzie, and P. M. Podsakoff (2003) "A Critical Review of Construct Indicators and Measurement Model Misspecification in Marketing and Consumer Research," *Journal of Consumer Research*, (30)2, pp. 199-218.
Jeppesen, L. B. and L. Frederiksen (2006) "Why Do Users Contribute to Firm-hosted User Communities? The Case of Computer-controlled Music Instruments," *Organization Science*, (17)1, pp. 45-63.
Jones, A. and J. Preece (2006) "Online Communities for Teachers and Lifelong Learners: A Framework for Comparing Similarities and Identifying Differences in Communities of Practice and Communities of Interest," International Journal of Learning Technology, (2)2/3, pp. 112-137.
Jones, Q., Ravid, G., and S. Rafaeli (2004) "Information Overload and the Message Dynamics of Online Interaction Spaces: A Theoretical Model and Empirical Exploration," *Information Systems Research,* (15)2, pp. 194–210.
Kankanhalli, A., B. C. Y. Tan, and K. K. Wei (2005a) "Contributing Knowledge to Electronic Knowledge Repositories: An Empirical Investigation," *MIS Quarterly,* (29)1, pp. 113-143.
Kankanhalli, A., B. C. Y. Tan, and K. K. Wei (2005b) "Understanding Seeking from Electronic Knowledge Repositories: An Empirical Study," *Journal of the American Society for Information Science and Technology,* (56)11, pp. 1156-1166.
Katz, J. (1998) "Luring the Lurkers," Slashdot [Available online: http://slashdot.org/features/98/12/28/1745252.shtml].
Keil, M., B. C. Y. Tan, K. K. Wei, T. Saarinen, V. Tuunainen, and A. Wassenaar (2000) "A Cross-cultural Study on Escalation of Commitment Behavior in Software Projects," *MIS Quarterly,* (24)2, pp. 299-325.
Kling, R. and C. Courtright (2003) "Group Behavior and Learning in Electronic Forums: A Sociotechnical Approach," *The Information Society*, 19, pp. 221-235.
Kraaijenbrink, J., and F. Wijnhoven (2008) "Managing Heterogeneous Knowledge: A Theory of External Knowledge Integration," *Knowledge Management Research & Practice*, 6, pp. 274–286.
Krishnan, R., X. Martin, and N. G. Noorderhaven (2006) "When Does Trust Matter to Alliance Performance?" *Academy of Management Journal*, (49)5, pp. 894-917.
Law, K.S., C. Wong, and W. H. Mobley (1998) "Toward a Taxonomy of Multidimensional Constructs," *Academy of Management Review,* (23)4, pp. 741-755.
Lazar, J. and J. Preece (2002) "Social Considerations in Online Communities: Usability, Sociability and Success Factors" in H. van Oostendorp (ed.) *Cognition in the Digital World*. NJ: Lawrence Erlbaum Associates Inc.
Lecerof, A. and F. Paterno (1998) "Automatic Support for Usability Evaluation," *IEEE Transactions on Software Engineering,* (24)10, pp. 863–888.
Lin, L., X. Geng, and A.B. Whinston (2005) "A Sender-Receiver Framework for Knowledge Transfer," *MIS Quarterly*, (29)2, pp. 197-219.
Ling, K., G. Beenen, P. Ludford, X. Wang, K. Chang, X. Li, D. Cosley, D. Frankowski, L. Terveen, A. M. Rashid, P. Resnick, and R. Kraut (2005) "Using Social Psychology to Motivate Contributions to Online Communities," *Journal of Computer.-Mediated Communication*, (10)4.
Löwgren, J. (2002) "How Far Beyond Human-computer-interaction is Interaction Design," *Digital Creativity,* (13)3, pp. 186–192.
Luppicini, R. (2007) *Online Learning Communities* (Ed.). Greenwich: Information Age Publishing.
Ma, M. and R. Agarwal (2007) "Through a Glass Darkly: Information Technology Design, Identity Verification, and Knowledge Contribution in Online Communities," *Information System Research*, (18)1, pp. 42-67.
Maloney-Krichmar, D., C. Abras, and J. Preece. (2002) "Revitalizing a Stalled Online Community: Beyond User-centered Design," *Social Implications of Information and Communication Technology, International Symposium on Technology and Society ISTAS'02,* pp. 13-19.

Maloney-Krichmar, D. and J. Preece (2005) "A Multilevel Analysis of Sociability, Usability and Community Dynamics in an Online Health Community," *ACM Transactions on Computer-Human Interaction,* (12)2, pp. 201-232.
Marchionini, G. (1992) "Interfaces for End-user Information Seeking," *Journal of the American Society for Information Science,* (43)2, pp. 156-163.
Marchionini, G. (1995) *Information Seeking in an Electronic Environment*. Cambridge: Cambridge University Press.
Markus, M. L. (2001) "Towards a Theory of Knowledge Reuse: Types of Knowledge Reuse Situations and Factors in Reuse Success," *Journal of MIS,* (18)1, pp. 57-94.
Marsh, H. W. (1994) "Confirmatory Factor Analysis Models of Factorial Invariance: A Multifaceted Approach," *Structural Equation Modeling,* (1)1, pp. 5-34.
Mattila, A. S. and C. A. Enz (2002) "The Role of Emotions in Service Encounter," *Journal of Service Research*, (4)4, pp. 268-277.
McCormack, A., K. Herman, and S. Völpel (2002) "Siemens ShareNet: Building a Knowledge Network," *Harvard Business Case* (9-603-036). Boston, MA: Harvard Business School Publishing.
Miller, R. B. (1971) "Human Ease of Use Criteria and Their Tradeoffs," *IBM Technical Report* TR 00.2185, IBM Corporation, Poughkeepsie, NY.
Moore, G.C. and I. Benbasat (1991) "Development of an Instrument to Measure Perceptions of Adopting an Information Technology Innovation," *Information Systems Research,* (2)3, pp. 192-222.
Moser, J. (1997). "The Origins of the Austrian School of Economics," *Humane Studies Review*, 11(1).
Newman, W. and A. Taylor (1999) "Towards a Methodology Employing Critical Parameters to Deliver Performance Improvements in Interactive Systems," *Proceedings of IFIP TC.13 International Conference on Human–Computer Interaction*, IOS Press, Amsterdam, pp. 605–612.
Nielsen, J. (2000) *Designing Web Usability*. Indianapolis: New Riders.
Nielsen, J. (2006) "Participation Inequality: Encouraging More Users to Contribute," Jakob Nielsen's Alertbox, October 9, 2006, [Available: http://www.useit.com/alertbox/participation_inequality.html].
Nunnally, J. (1978) *Psychometric Theory*. NY: McGraw-Hill.
Palmer, J. W. (2002) "Web Site Usability, Design, and Performance Metrics," *Information Systems Research*, (13)2, pp. 151-167.
Peddibhotla, N. and M. R. Subramani (2007) "Contributing to Public Document Repositories: A Critical Mass Theory Perspective," *Organization Studies*, (28)3, pp. 327-346.
Petter, S., D. Straub, and A. Rai (2007) "Specifying Formative Constructs in Information Systems Research," *MIS Quarterly*, (31)4, pp. 623-656.
Preece, J. (2000) *Online Communities: Designing Usability and Supporting Sociability*. Chichester: John Wiley & Sons.
Preece, J. (2001) "Sociability and Usability in Online Communities: Determining and Measuring Success," *Behavior & Information Technology*, (20)5, pp. 347-356.
Rafaeli, S. and F. Sudweeks (1997) "Networked Interactivity," *Journal of Computer-Mediated Communication*, (2)4.
Shackel, B. (1991) "Usability - Context, Framework, Definition, Design and Evaluation" in B. Shackel and S. Richardson (eds.) *Human Factors for Informatics Usability.* Cambridge: Cambridge University Press, pp. 21–38.
Shneiderman, B. (1998) *Designing the User Interface*. Reading, MA: Addison-Wesley.
Stanoevska-Slabeva, K. and B. F. Schmid (2001) "A Typology of Online Communities and Community Supporting Platforms," *Proceedings of the 34th Annual Hawaii International Conference on Systems Sciences*, HI: IEEE Computer Society Press, pp. 7010-7019.
Steenkamp, J-B. E. M. and H. Baumgartner (1998) "Assessing Measurement Invariance in Cross-national Consumer Research," *Journal of Consumer Research,* (25)1, pp. 78-90.
Steensma, H. K., L. Tihanyi, M. A. Lyles, and C. Dhanaraj (2005) "The Evolving Value of Foreign Partnerships in Transitioning Economies," *Academy of Management Journal*, (48)2, pp. 213-235.
Subramani, M. (2004) "How do Suppliers Benefit from Information Technology Use in Supply Chain Relationships?" *MIS Quarterly*, (28)1, pp. 45–73.

Taylor, S. and P. A. Todd (1995) "Understanding Information Technology Usage: A Test of Competing Models," *Information Systems Research,* (6)2, pp. 144-176.
Tedjamulia, S. J. J., D. R. Olsen, D. L. Dean, and C. C, Albrecht (2005) "Motivating Content Contributions to Online Communities: Toward a More Comprehensive Theory," *Proceedings of the 38th Hawaii International Conference on System Sciences*, IEEE.
Tolmie, A. and J. Boyle (2000) "Factors Influencing the Success of Computer Mediated Communication (CMC) Environments in University Teaching: A Review and Case Study," *Computers and Education*, 34, pp.119–140.
Trist, E. and H. Murray (1993) *The Social Engagement of Social Science: A Tavistock Anthology (vol. II)*. Philadelphia: University of Pennsylvania Press.
Valck, K., F. Langerak, P. C. Verhoef, and P. W. J. Verlegh (2007) "Satisfaction with Virtual Communities of Interest: Effect on Members' Visit Frequency," *British Journal of Management*, (18)3, pp. 241-256.
Vandenberg, R. J. (2002) "Toward a Further Understanding of and Improvement in Measurement Invariance Methods and Procedures," *Organizational Research Methods,* (5)2, pp. 139-58.
Venkatesh, V. (2000) "Determinants of Perceived Ease of Use: Integrating Perceived Behavioral Control, Computer Anxiety and Enjoyment into the Technology Acceptance Model," *Information Systems Research,* (11)4, pp. 342–365
Wasko, M. and S. Faraj (2000) "It is What One Does: Why People Participate and Help Others in Electronic Communities of Practice," *Journal of Strategic Information Systems,* (9)2-3, pp. 155-173.
Wasko, M. and S. Faraj (2005) "Why Should I Share? Examining Social Capital and Knowledge Contribution in Electronic Networks of Practice," *MIS Quarterly*, (29)1, pp. 35-57.
Wasko, M., S. Faraj, and R. Teigland (2004) "Collective Action and Knowledge Contribution in Electronic Networks of Practice," *Journal of the Association for Information Systems*, (5)11-12, pp. 493-513.
Wenger, E. (1998) *Communities of Practice: Learning, Meaning, and Identity*. Cambridge: Cambridge University Press.
Wright, S. and J. Street (2007) "Democracy, Deliberation and Design: The Case of Online Discussion Forums," *New Media Society*, (9)5, pp. 848-869.
Xie, H. (2003) "Supporting Ease-of-use and User Control: Desired Features and Structure of Web-based Online IR Systems," *Information Processing and Management,* (39)6, pp. 899-922.
Xie, H. and C. Cool (2000) "Ease-of-use Versus User Control: An Evaluation of Web and Non-web Interfaces of Online Databases," *Online Information Review,* (24)2, pp. 102-115.
Zhang, W. and S. Watt (2003) "Knowledge Adoption in Online Communities of Practice" in S. T. March, A. Massey, and J. I. DeGross (eds.) P*roceedings of International Conference on Information Systems*, Seattle, Washington, pp. 96-109.

Appendix A

A.1. Configural Invariance Test

Configural invariance is satisfied as long as the basic model structure (i.e., the pattern of fixed and free parameters) is invariant across groups (Vandenberg, 2002). This initial baseline model does not impose between-group invariance constraint on estimated parameters (Marsh, 1994). It forms the basis for subsequent invariance tests, i.e., metric and scalar invariance. Configural invariance is tested by constraining the patterns of item-factor relationships to be the same across groups. The fulfillment of the test can be assessed from the fit indices (IFI, NNFI, CFI, RMSEA) of the combined model of different groups that is imposed with such constraint (same pattern of item-factor relationships). The results shown in Table A1 suggest that the fit of the configural invariance (baseline) model is acceptable (with IFI, NNFI, and CFI above 0.90, and RMSEA below 0.08), thus establishing configural invariance between the groups of respondents for knowledge seeking and knowledge contribution.

A.2. Metric Invariance Test

Metric invariance test is conducted following the configural invariance test. Metric invariance should be satisfied for differences in scores on observed items to be indicative of similar differences in the underlying construct, and for such differences to be meaningfully compared across groups (Steenkamp and Baumgartner, 1998). Metric invariance (whether the items measure the latent variable on the same metric) is tested by constraining the factor loadings to be equal across groups (in addition to having same patterns of item-factor relationships). Metric invariance is established when the difference in CFI between the new constrained model and the baseline model (ΔCFI) is less than 0.01 (Cheung and Rensvold, 2002). Difference in CFI is assessed instead of χ^2 as it is independent of both model complexity and sample size, and is not correlated with the overall fit measures. The results (Table A1) show that ΔCFI (baseline – metric, i.e., 0.9584 – 0.9550 = 0.0034) is well below 0.01, thus satisfying metric invariance.

A.3. Scalar Invariance Test

Scalar invariance test is the most difficult to satisfy among the three invariance tests. Scalar invariance implies that subjects with the same value on the latent construct should have equal values on the observed variable (Hong et al., 2003). In other words, across-group differences in the means of the observed items should stem from differences in the means of underlying constructs. Scalar invariance is tested by constraining the intercepts of items to be the same across groups. As with metric invariance, scalar invariance is satisfied when the difference in CFI between the new constrained model and the preceding model (i.e., metric invariance model) is less than 0.01 (Cheung and Rensvold, 2002). The results (Table A1) show that ΔCFI (metric – scalar) marginally exceeds the 0.01 threshold (0.9550 – 0.9442 = 0.0108), which indicates that scalar invariance is largely satisfied.

Table A1: Results of Measurement Invariance Tests

Model	χ^2	df	IFI	NNFI	CFI	RMSEA
Seeking	167.57	104	0.96	0.95	0.96	0.072
Contribution	177.35	104	0.96	0.95	0.96	0.079
Baseline (Configural)	345.17	208	0.96	0.95	0.9584	0.075
Metric	367.42	219	0.96	0.94	0.9550	0.076
Scalar	424.93	241	0.95	0.94	0.9442	0.081

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Journal of the Association for Information Systems

ISSN: 1536-9323