10-2010

Effects of national culture on types of knowledge sharing in virtual communities

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Effects of National Culture on Types of Knowledge Sharing in Virtual Communities

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Abstract*—*Organizations are using virtual communities to facilitate knowledge management and to enhance communication among employees, customers, and other interested individuals. Individual users can use virtual communities to engage in knowledge sharing. Professional communicators need to understand and adapt to a globalized and "flat" world, where people across different cultures interact freely and easily with one another in virtual communities. An intriguing question regarding virtual communities relates to whether national culture affects communication and types of knowledge sharing. This study examines the influence of US and Chinese national cultures on types of knowledge-sharing activities in virtual communities. The findings indicate that national culture differences between China and the US are also evident in virtual community environments.

Index Terms*—*Cultural differences, knowledge sharing, professional communication, virtual communities.

Knowledge management has emerged as a vital resource contributing to the competitiveness and survival of today's organizations [1]. Nearly 30% of the Fortune 1000 companies included knowledge-management initiatives in their corporate planning [2]. Researchers such as Wasko and Faraj stressed that knowledge management is a necessary condition for sustaining a competitive advantage [3]. Although research has been conducted to investigate the scope, complexity, and difficulties of engaging in knowledge management within organizations, many other areas, such as knowledge sharing in virtual communities, remain unexplored. Even though many organizations have developed their own virtual communities via intranets [4], the phenomenon and patterns of communication are not well understood. In today's global, internet-enabled business environment, these same businesses often find themselves in the position to manage diverse cultures online, and national culture has been shown to be a factor influencing communication. Hence, the effects of national culture on virtual communities and professional communication warrant further understanding and study [5]–[10].

Manuscript received September 18, 2008; revised May 14, 2009; accepted May 15, 2009. Date of current version August 25, 2010.
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Color versions of one or more of the figures in this paper are available online at http://ieeexplore.ieee.org.
IEEE 10.1109/TPC.2010.2052842

VIRTUAL COMMUNITIES

Virtual communities have been the subject of many recent studies. Knowledge sharing is one of the most important functions of virtual communities [11]–[17]. In contrast to physical knowledge-sharing communities, virtual knowledge-sharing communities have decentralized structures [15]. Wasko and Faraj defined a virtual community as a "self-organizing, open activity system focused on a shared practice that exists primarily through computer-mediated communication" [17, p. 37].

Our research views virtual communities as comprising the following characteristics:

- "Virtual" (as compared with "face-to-face," "physical") content: Members are in dispersed geographical locations [18];
- Peer-to-peer, decentralized structure: Flat (in contrast to hierarchal) structure [15];
- Anonymous members: True identities of members are typically not known;
- Open membership and voluntary contributions: Membership is open to the public and members voluntarily contribute knowledge to the communities;
- Asynchronous communication modes: Instantaneous feedback is unlikely [19].

IMPORTANCE OF RESEARCH

Given the characteristics of virtual communities and their increasing popularity over traditional face-to-face communities, it is essential to understand how virtual communities facilitate knowledge sharing. Knowledge-sharing activities could be different in virtual communities because members are geographically dispersed rather

than co-located. Businesses are increasingly using virtual communities for professional communication and knowledge retrieval and dissemination. In addition, more individuals are relying on virtual communities to acquire needed knowledge [12]. Du and Wagner found that even educators have begun to create knowledge-sharing communities via weblogs and enhancements to WebCT (Blackboard) [20]. This means that virtual communities now assume at least some of the functions traditionally provided by physical libraries. An important question that emerges is the influence of national culture on knowledge-sharing behaviors in virtual community environments.

One can argue that the influence of national culture is minimized because people from different cultural backgrounds can participate easily in the same virtual community. Thus, it would seem that existing cultural norms do not affect knowledge-sharing behaviors. On the other hand, one can expect national culture to affect people's behavior when participating in virtual communities because most virtual communities are local to a specific country or to a specific language, even though the site is theoretically accessible to the whole world (e.g., language barriers as well as cultural and social factors limit participation). Furthermore, participating in virtual communities does not change a participant's national culture.

An examination of the current literature reveals that few studies have directly addressed or examined national culture differences in virtual communities from the perspective of knowledge sharing. An empirical investigation is necessary to study and understand cultural impact on virtual communities. We believe this research will contribute to the current knowledge-management, culture, and communication literature, as well as provide information on communication practices within virtual communities. An understanding of the impact of national culture on virtual communities will help in designing better knowledge-management and knowledge-sharing systems and also aid in shaping policies that advocate knowledge sharing in these environments. Awareness of different national cultures will also prompt participants to be sensitive to each other's culture during online communication.

In this paper, we try to fill the gap in the literature by analyzing knowledge-sharing behaviors in virtual communities from a national culture perspective. US (American) and Chinese national cultures are studied in this research, and 18 virtual communities were content coded. Hofstede's theory serves as the conceptual foundation for the research.

LITERATURE REVIEW

Knowledge The general perception about knowledge is that it is located in the minds of individuals: It is personalized information related to facts, procedures, concepts, interpretations, ideas, observations, and judgments (which may or may not be unique, useful, accurate, or structurable) [21]. Nonaka and Huber defined knowledge as justified personal beliefs that increase an individual's capacity to take effective action [22], [23]. Drucker described knowledge as information that changes something or somebody—either by becoming grounds for actions or by making an individual (or an institution) capable of different or more effective action [24].

Information systems (IS) literature distinguishes among knowledge, information, and data. According to Maglitta, Davenport, and Prusak [25], [26], data are raw numbers and facts, information is processed data, and knowledge is information made actionable. There are many more definitions or conceptualizations of knowledge, but we limit the list to those most related or relevant to this research.

Knowledge Dimensions Although there is no universal standard for classifying the different types of knowledge, many studies have examined knowledge by proposing a number of knowledge dimensions, with the primary ideas revolving around tacit and explicit knowledge [22], [25], [27]–[30]. Tacit knowledge is personal, context specific, and, therefore, difficult to formalize and communicate. On the other hand, explicit or "codified" knowledge refers to knowledge that is transmittable in formal, systematic language [19], [31]. Nickols distinguished knowledge among declarative, procedural, and strategic knowledge [32]. "Strategic knowledge" is a term used by some to refer to what might be termed "Know-when" and "Know-why." In some cases, both declarative and procedural knowledge can be strategic knowledge.

Machlup distinguished between "Know-that" and "Know-how" and defined four distinct types of know-how knowledge: descriptive knowledge, historical knowledge, theoretical knowledge, and procedural knowledge [33]. He presented a framework for understanding and categorizing knowledge. Classical philosophers were chiefly

interested in the meaning of "knowing that," that is, propositional knowing or propositional knowledge. Knowledge of know-that (propositional knowledge) means that something is so and not otherwise. On the other hand, knowledge of know-how is immediately practical, since it is a skill or ability to do something and is a capacity to perform. Machlup further differentiated between the various types of knowing-how by the degree of attention they require in performance: (1) descriptive knowledge—knowing how something looks; (2) historical knowledge—knowing how something has happened; (3) theoretical knowledge—knowing how something is generally or universally connected with something else; and (4) procedural knowledge—knowing how to perform a certain task [33, p. 32].

Knowledge Sharing and Knowledge Management

Newman defined knowledge management as the collection of processes that govern the creation, dissemination, and utilization of knowledge [30]. Alavi and Leidner provided a more elaborate definition of knowledge management as a systemic and organizationally specified process for acquiring, organizing, and communicating tacit and explicit knowledge of employees so that others may make use of it to be more effective and productive [21]. Skyrme viewed knowledge management as comprising the following categories: knowledge creation, knowledge accumulation, knowledge dissemination, knowledge sharing, and knowledge use [34].

A study by Gupta and Govindarajan provided insight into the process of building a knowledge-sharing environment [35]. They presented the main elements of the knowledge-management process as knowledge creation, knowledge acquisition, knowledge retention, knowledge identification, knowledge outflow, knowledge transmission, and knowledge inflow. Nah et al. developed a research model in e-commerce that consists of three components: knowledge acquisition, knowledge dissemination, and knowledge sharing [19]. Knowledge dissemination refers to delivering knowledge to potential customers, whereas knowledge acquisition refers to the acquisition of customer knowledge. Knowledge sharing enables participants to provide online knowledge to other peer participants.

Most of the existing knowledge-management literature focuses on how to manage organizational knowledge and how to enhance collaboration and sharing within organizations, but knowledge sharing in virtual communities is an important area that remains largely understudied. Ardichvili et al. began examining the issue related to knowledge sharing in virtual communities [11], [36]. Ardichvili, Page, and Wentling examined barriers to online community contributions and participation for employees at Caterpillar Inc. [36]. Their results indicated that individuals viewed virtual communities as a repository for the public good, and the intent was to benefit the collective, rather than the individual. Another more critical barrier identified was that if the existing social networks were strong, there would be little benefit in creating a more formal online community [27]. Ardichvili, Page, and Wentling's study also found barriers related to the nature of the problem—that the Knowledge Management Forum (online community) might provide inaccurate results [36]. Fear of contributing inaccurate knowledge was also found to be an inhibiting factor in terms of participation. Their study, however, did not specifically examine culture as part of the research.

Ardichvili et al. examined the effect of culture on knowledge sharing in virtual communities [11]. The study expanded on the 2003 work in that culture was included in the study design [36]. Specifically, the cultural differences were examined in Caterpillar Inc. facilities located in the US, Brazil, Russia, and China. Generally, the results indicated that while there were differences among the countries, even the collectivist orientation to "save face" was often (at least sometimes) superseded by the drive to do a good job. In other words, the employees generally felt that it was better to ask questions within the company and get it right, rather than to make a mistake in front of the client. The study was exploratory and did not purport to measure cultural differences in virtual communities, but rather interviewed employees based on the following seven assumptions: modesty (saving face), deference to senior status (old versus young), hierarchical and political issues, top managers not participating (if in a hierarchical orientation), cultural preference for face-to-face communication, willingness of one group to share with another group, and information-hoarding orientations. While the study identified a number of barriers to knowledge sharing in virtual communities, one of the research implications was a call for more empirical studies to understand the impact of national culture characteristics on online knowledge sharing [11], which is exactly the gap the current research attempts to investigate.

Culture Although it has been acknowledged that culture plays a role in knowledge management [37], issues relating to the influence of culture on knowledge sharing in online communities have been rarely studied in past research. Jarvenpaa and Staples examined the influence of organizational culture on knowledge management/sharing [38], while other IS researchers have focused mainly on the relationship between national culture and IS implementation (e.g., Polanyi [39]). Ardichvili et al., as previously indicated, conducted a qualitative study of national and ethnic cultural impacts on knowledge sharing in virtual communities at Caterpillar Inc. [11]. They concluded that culture played a role in knowledge sharing and called for more studies on the phenomenon. But there seems to be little research in the area, which once again highlights the need for research in the areas of knowledge sharing and national culture.

Hofstede defined culture as mental programming [40], which refers to patterns of thinking, feeling, and potential acting, which were learned throughout people's lifetimes. Hofstede studied national culture using IBM employees in more than 50 countries. Hofstede's study showed that the values of employees differed more based on their nationality, age, and education than on their membership in organizations [40]. Hofstede also identified four dimensions that could be used to distinguish among different cultures: individualism versus collectivism, masculinity versus femininity, power distance (from small/low to large/high), and uncertainty avoidance (from weak/low to strong/high). A fifth dimension, long-term versus short-term orientation, was added in 1991 [28].

Individualism refers to the degree to which people in a culture prefer to act as individuals rather than as members of groups. Masculinity is the degree to which values like assertiveness, performance, success, and competition prevail among people of a culture. Power distance refers to the degree of inequality among people that the population of a culture considers normal. Uncertainty avoidance is the degree to which people in a culture feel uncomfortable with uncertainty and ambiguity. Long-term orientation, which is said to be the Confucian dynamism, refers to values such as persistence, thrift, preserving status-based relationships, and deferred gratifications. Its counterpart, short-term orientation, involves more inclination toward consumption or saving face by keeping up.

Triandis cited a number of previously identified attributes of individualism and collectivism [41, pp. 44–45]. In particular, four types of self were described: independent versus interdependent, and same versus different. Horizontal individualism is more or less composed of independent/same selves, horizontal collectivism as interdependent/same selves, vertical individualism as independent/different selves, and vertical collectivism as interdependent/different selves. These definitions allowed for better descriptions of individual differences and subcategories within the more general individualist or collectivist cultures.

Triandis further identified what he called individualism factors and collectivism factors [41, p. 81]. He also determined that, at least in his study's results, individualism and collectivism were not necessarily opposites on a continuum, but rather uncorrelated constructs in which people could possess characteristics of individualism and collectivism simultaneously at high or low levels. This contrasts to a certain extent with Hofstede's work [28], [40], [42]. Hofstede's conceptualization of national culture is distinct from that of Triandis—although Hofstede's individualism construct is directly addressed by Triandis, the others are not.

Bond's Chinese Culture Connection (CCC) study revealed four factors derived from the Chinese culture: integration, Confucian work dynamism, human-heartedness, and moral discipline [43]. Another well-known, cross-cultural researcher, Schwartz, surveyed 56 value preferences in 25 countries and found 10 motivationally distinct value types: power, achievement, tradition, hedonism, self-direction, universalism, security, stimulation, benevolence, and conformity types [44]. In his follow-up work, he identified two fundamental dimensions of culture variations: openness to change (includes self-direction and stimulation value types) versus conservation (includes security, conformity, and traditional value types) and self-enhancement (includes hedonism, power, and achievement value types) versus self-transcendence (includes universalism and benevolence value types).

Trompenaars classified national culture into three dimensions: how people relate to each other, people's attitudes toward time, and people's attitudes toward their environment [45]. He defined five dimensions of how people relate to each other: universalism-particularism

(obligation to an individual versus obligation to the society), achievement-ascription (status determined by achievements or ascriptions), individualism-collectivism (degree of orientation to the self), affectivity-neutrality (express/show or control/hide feelings), and specificity-diffuseness (degree of engaging others in specific areas or in multiple areas). Compared to Hofstede's research, the strength of Trompenaars's research is that it addresses detailed insights of relationships among people.

Although the dimensions introduced by these researchers are diverse and varied, most of them capture a similar essence. For example, an analysis by Smith, Dugan, and Trompenaars indicated that the four factors of Bond's CCC study correlate with several dimensions of Hofstede's [46]. The individualism-collectivism dimension is stated by different researchers in different ways and was recognized as the most important yield of cross-cultural psychology [46].

Culture and Knowledge Management in Online Communities A study by Jarvenpaa and Staples examined the use of collaborative electronic media for information sharing in a public university setting in Australia [38]. Jarvenpaa and Staples took a different (and stricter) approach to their study by proposing that what gets sent (electronically in this case) must be either data or information; as such, it cannot be considered as knowledge until it has been shaped, contextualized, and used appropriately. Jarvenpaa and Staples approached culture from an organizational- and information-culture perspective and did not specifically include national culture as a construct or variable in their model. Raman and Watson's study, on the other hand, examined IS development problems from three perspectives of culture: national culture, organizational culture, and MIS culture [47]. However, knowledge management was not a part of the research. The primary focus of this study is to examine national culture and its effects on knowledge acquisition and dissemination in the online community environment.

Wasko and Faraj examined knowledge sharing and exchange in three virtual communities, specifically focusing on the reasons people participate in these activities [17]. While the reasons proposed for participation in sharing (which include social acceptance, a desire to help others, or doing the right thing) appear to be valid, the study skirts the issue of national culture with regard to knowledge sharing and exchange.

Although several studies have addressed knowledge sharing and exchange in virtual communities, they have not investigated the effect of national culture (e.g., [17]). While Jarvenpaa and Staples examined organizational and information culture in a university setting, they did not study national culture [38]. Raman and Watson [47] and many others (e.g., Spender [48]), on the other hand, have primarily researched national culture and its relationship to IS development, implementation, and evaluation, but knowledge management was not addressed in these studies. An examination of the impact of national culture on knowledge management should shed light on a heretofore understudied area.

Conceptual Foundation and Research Hypotheses

This research addresses a gap in the literature involving knowledge acquisition and dissemination in virtual communities, using national culture as a primary explanatory vehicle. For the most part, the existing studies examined knowledge transfer from an organizational perspective, with the exception of Triandis [41], and did not explicitly address national culture. We examine two factors related to knowledge in this research: (1) knowledge acquisition and dissemination and (2) knowledge types.

Hypotheses Related to Knowledge Acquisition and Dissemination In the context of virtual communities, knowledge acquisition can be defined as the posting of messages to seek others' knowledge. Knowledge dissemination, on the other hand, is the posting of messages in response to requests for knowledge (i.e., knowledge-acquisition messages). In this research, we focus only on messages related to acquisition and dissemination of knowledge, and any differences in those message types between US-based and China-based sites. Messages that are related to personal greetings and other purposes, such as building social networks, are outside the scope of this research.

In the area of cross-cultural research, none of the studies are as comprehensive or widely used as Hofstede's theory. Hofstede's theory has been supported by many empirical studies carried out by various researchers (e.g., [34]). One of the reasons for the popularity of Hofstede's work is that it is based on a very large-scale survey of data collected from 16,000 multinational corporations. Unlike other research that focuses on basic human values unrelated to nationality, Hofstede's dimensions

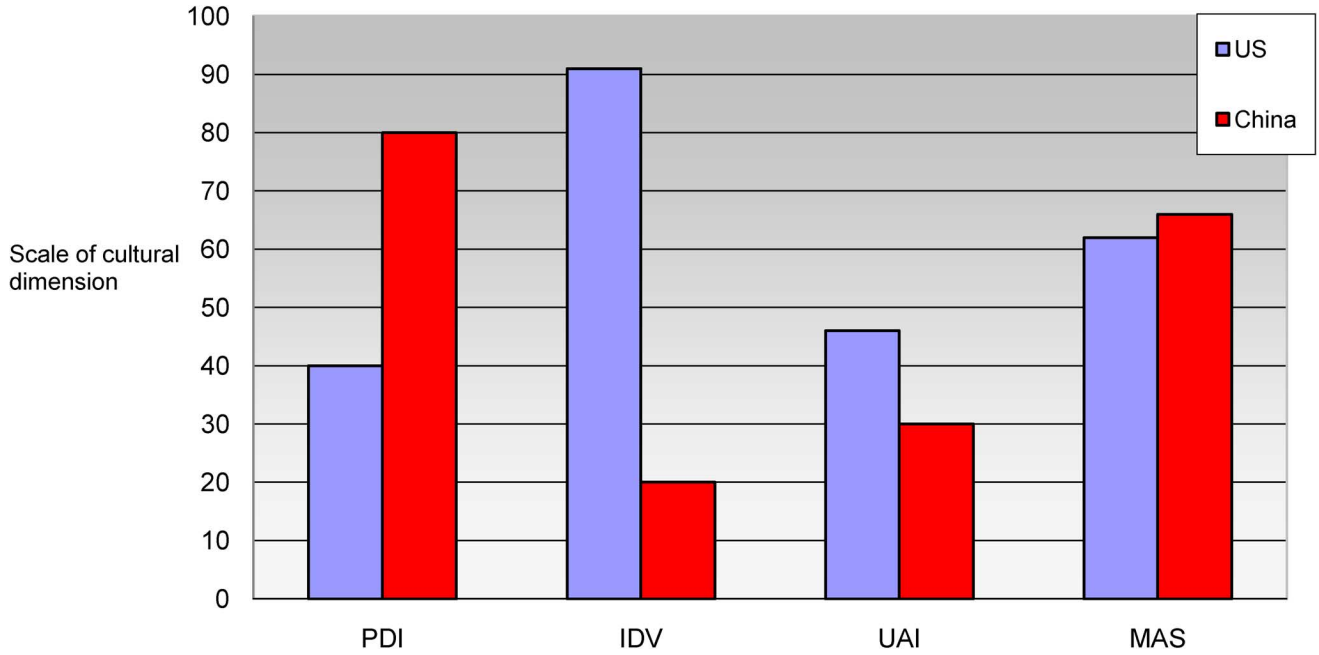

Fig. 1. Culture comparisons of US and China.

are extremely appropriate for examining national culture differences. Although Triandis also provided enhancements to Hofstede's (and others') dimensions of culture, such as horizontal and vertical, these are not specifically examined in this research [41, pp. 44–45]. While Hofstede's research efforts have mainly focused on the effects of national culture on workplace and organizational environment, the effect of culture should also be evident in knowledge sharing in virtual community environments.

The objective of this research is to identify differences in knowledge-sharing activities between different national cultures in virtual community environments. We focus on differences in knowledge-sharing activities between Chinese and American virtual communities. Using Hofstede's cultural dimensions indices [28], [40], we obtained Fig. 1.

It can be seen from Fig. 1 that American and Chinese national cultures are very different on two dimensions: power distance and individualism-collectivism.

Power Distance: Power distance, or the degree of inequality among people which the population of a culture considers normal, may influence knowledge exchange in virtual community environments [12]. Power distance is relatively higher in Chinese culture than in American culture (80 versus 40). In a culture with large power distance, inequalities among people are expected and desired [42]. In this type of culture, it can be argued that experts are less likely or willing to share knowledge with others. Novices or people of lower rank may seek advice or knowledge from experts in virtual communities, but these requests may not be answered. (The phenomenon, however, may differ in an organizational context where higher-ranking personnel have a responsibility to help subordinates for organizational success.) In a culture with small power distance, inequalities among people are minimized. Thus, we can hypothesize that

> **H1**. American virtual communities will include more knowledge-sharing messages (both acquisitions and disseminations) than Chinese virtual communities.
> **H2**. Chinese virtual communities will offer fewer knowledge-dissemination messages than American virtual communities.

Individualism-Collectivism: Individualism versus collectivism is another cultural difference that affects the knowledge-sharing characteristics in virtual communities. Americans rank high on the scale of individualism, while Chinese people rank low in terms of individualism (or high in collectivism). As shown in Fig. 1, the individualism index of Americans is 91, whereas that of Chinese is 20, indicating a large difference between the two cultures. In a collectivist society, social networks are the primary source of

information, whereas in an individualist society, the media are a primary source of information [42]. Therefore, we hypothesize the following:

> **H3**. Chinese virtual communities will have fewer knowledge-acquisition messages than American virtual communities.

Furthermore, in an individualist society, everyone is expected to have a private opinion [42]. People are more independent. An individualistic culture (e.g., Americans) is one where ties between people are loose and members base their self-understanding on their own actions, which are usually taken independently of what others think [49]. Members of American virtual communities are likely to be more willing to express their opinions and solutions or to defend their point of view. In other words, the proportion of knowledge-acquisition and knowledge-dissemination messages should be different between American virtual communities and their Chinese counterparts. We expect American virtual communities to post more knowledge-dissemination messages for each knowledge-acquisition message—in other words, each knowledge-acquisition message should generate more responses in American virtual communities than in Chinese virtual communities. Thus, we hypothesize that

> **H4**. The proportion of knowledge-acquisition and knowledge-dissemination messages is different between Chinese and American online virtual communities.

Hypothesis Related to Knowledge Types To classify the types of knowledge that are exchanged in virtual communities, we used the knowledge dimensions proposed by Machlup [33] and the cultural dimensions developed by Hofstede [28], [40], [42]. Specifically, five types of knowledge were coded in this research: (1) propositional knowledge—knowing that something is the case, (2) descriptive knowledge—knowing how something looks, (3) historical knowledge—knowing how something has happened, (4) theoretical knowledge—knowing how something is generally or universally connected with something else, and (5) procedural knowledge—knowing how to perform a certain task.

We adopted Machlup's knowledge dimensions as our conceptual basis for several reasons: (1) Machlup's knowledge dimensions have been used by many other researchers as the foundation for studying and classifying different types of knowledge; (2) compared to other existing classifications, the five knowledge dimensions proposed by Machlup are the most comprehensive and relevant for studying the different types of knowledge that are exchanged in virtual communities; and (3) these knowledge dimensions worked very well when tested in a pilot study [33]. While many other knowledge dimensions that have been proposed include tacit knowledge, and tacit knowledge is undoubtedly an important knowledge type in knowledge management, tacit knowledge is not visible and, thus, not applicable to this research, which studies knowledge sharing and exchange in virtual communities. This paper, therefore, focuses on examining different types of explicit knowledge.

Because of the differences in the national cultures of China and the US, we hypothesize that national culture will affect the types of knowledge that are exchanged in virtual communities. For example, Chinese are more interested in how other people deal with or solve problems—in other words, what is the standard and generally accepted way of doing something. There is a tendency and expectation for Chinese to follow the norm. However, Americans prefer to make their own decisions about how things should be done. As such, we expect a larger number of exchanges of theoretical knowledge in Chinese virtual communities, which is knowledge that deals with how something is generally accepted or viewed in terms of its relations to something else. According to Hofstede's research, people high in individualism usually participate to share their feelings (e.g., about their teen's behavior) instead of looking for a "standard solution."

> **H5**. Culture will affect the types of knowledge that are exchanged in virtual communities.

Research Methodology and Procedure

Research Sites To study the effect of cultural differences on knowledge sharing in virtual communities, we selected two cultures that are quite distinct according to Hofstede's studies—the US and China [28], [40], [42]. One advantage of studying American and Chinese communities is that Chinese virtual communities use Chinese as the medium for communication, whereas American virtual communities communicate in English. In this case, both groups use their native languages. If both groups of virtual communities used English as the medium of communication, the cultural differences might be minimized. Admittedly, it is

possible that a US or European native might be able to use Chinese to get involved in a Chinese online community or vice-versa. However, these are likely to be very rare instances. We believe that the vast majority of members in Chinese virtual communities have a Chinese cultural background. In addition, since our data involve a large volume of messages, even if there are messages posted by people with a non-Chinese cultural background, their impact should be minimal.

The data-collection process involved extracting messages posted on Chinese and American virtual communities. Eighteen equivalent online groups from American and Chinese Yahoo! virtual communities were chosen as the sample for our study. The 18 virtual communities were chosen because (1) they had a high frequency of knowledge-sharing activities in American (www.yahoo.com) and Chinese (www.yahoo.com.cn) Yahoo! virtual communities and (2) there were corresponding virtual communities in American and Chinese Yahoo! sites. The other communities either did not have a counterpart in the Yahoo! virtual community of the other culture (American/Chinese) or had a low frequency of message postings (i.e., an unpopular online community). Some virtual communities were not actually "virtual" in nature in that they involved a lot of physical communication, such as face-to-face meetings or other activities; these communities were not selected. The sample for this study comprises the 100 most recent message postings at the time of data collection in the 18 American and Chinese Yahoo! virtual communities. For some popular virtual communities, the 100 most recent messages were generated within a few days. For less-popular communities, the 100 most recent messages were generated within a few weeks. For each message, we determined whether the purpose was to acquire or disseminate knowledge (or neither). The types of knowledge that were requested or exchanged under each of these two basic forms of knowledge-sharing activities were analyzed.

Coding Two independent analysts coded the messages according to (1) whether the intention was acquisition or dissemination of knowledge, or neither and (2) Machlup's classification of types of knowledge (i.e., descriptive knowledge, historical knowledge, theoretical knowledge, procedural knowledge, and propositional knowledge).

The coding proceeded as follows: First, the two analysts coded 8 of the 18 online clubs independently. This represents 44% of the total data. Both coders (analysts) were Ph.D. students in a large Midwestern American university. Both coders are bilingual in English and Chinese with excellent written and oral skills in both languages. The interrater reliability between the two coders was 0.94, which represents a very high level of consistency between the two coders. We used Pearson's correlation to compute interrater reliability. Disagreements were resolved through consensus. Due to the high level of reliability in the coding (0.94) and the daunting task of coding 3,600 messages, the rest of the data set—messages from the other ten virtual communities—was split into two groups and coded separately by the two coders.

Results and Findings

The total number of knowledge-related messages (those containing knowledge content) was 1,761 (49%) of the 3,600 ($18 \times 100 \times 2$) message postings; 805 were from the Chinese virtual communities, and 956 were from the American virtual communities. We used a nonparametric Chi-square test because the data were frequency counts. A number of the underlying conditions that parametric tests are typically based upon could not be assumed. For example, parametric tests typically assume continuous variables. In our case, 1,761 posts were collected for the study; 805 from Chinese sites and 956 from American sites. They were first classified as either disseminating or acquiring knowledge. Then, they were further classified into the knowledge types: propositional, descriptive, historical, theoretical, and procedural. In other words, by classifying the data into discrete groups and counting the number of items in each, we were essentially looking at a binomial distribution for the acquire/disseminate variable and five possible groupings for the knowledge-types variable. Furthermore, because of the discrete nature of the data, the assumption for normality that was required for a parametric test was not met. Under these conditions, the Chi-square test is the appropriate statistic for the data set.

To test H1 (i.e., American virtual communities will include more knowledge-sharing messages than Chinese virtual communities), we carried out a Chi-square contingency-table analysis to assess the homogeneity of distributions between the frequency of knowledge-related and non-knowledge-related messages of the Chinese and American responses. The Chi-square results show a significant difference between American and Chinese virtual communities in terms of knowledge content. The Chi-square

test statistic (χ^2) was 25.35 (> 3.84, df = 1, $\alpha = 0.05$), indicating that the null hypothesis should be rejected, thus supporting H1. In other words, the level of knowledge content is higher in American virtual communities than in Chinese virtual communities. A possible reason for this result is that in Chinese society, people generally rely on closed and familiar groups for knowledge exchange. A more open system of knowledge exchange (as in the case of American virtual communities) is common and generally accepted in the US.

H2 was tested using the Chi-square contingency-table analysis to assess whether there is a difference in relative frequency of knowledge-dissemination (versus non-knowledge-dissemination) messages between American and Chinese Yahoo! virtual communities. The Chi-square test statistic was 43.66 (> 3.84, df = 1, $\alpha = 0.05$), suggesting that the null hypothesis should be rejected, thus supporting H2. The results indicate that in online community environments, Americans participate in knowledge dissemination more than Chinese. In Chinese culture, people are more inclined to help people within their closed system or people whom they already know, and they are less likely to contribute or disseminate knowledge to people whom they do not know. Furthermore, experts or people of high status are less likely to participate in and contribute their knowledge to virtual communities due to the perceived inequality in power between themselves and others, as suggested by the power-distance dimension in Hofstede's research. By sharing their knowledge and participating in virtual communities, they might be viewed as relinquishing their power to others.

To test H3, we carried out a Chi-square contingency-table analysis to assess whether there is a difference in the relative frequency of knowledge-acquisition (versus non-knowledge-acquisition) messages between American and Chinese Yahoo! virtual communities. The Chi-square test statistic was 3.33 (< 3.84, df = 1, $\alpha = 0.05$), indicating that H3 is not supported. The results suggest that there is no significant difference between the number of knowledge-acquisition messages found in American and Chinese Yahoo! virtual communities. Although we expected the Chinese to acquire knowledge mostly through their closed, personal network (rather than through virtual communities), the results show that this may not be the case. This finding may be due to the limited number of people who are typically included in a closed, personal network. If the size of a personal network is small, it would be neither possible nor wise to rely exclusively on the group for the acquisition of certain knowledge.

H4 tested whether the proportion of knowledge-acquisition and knowledge-dissemination messages is different between Chinese and American online virtual communities. A Chi-square contingency-table analysis was carried out to assess whether there are differences between American and Chinese virtual communities in terms of knowledge acquisition versus dissemination. The Chi-square results show a significant difference between American and Chinese virtual communities in terms of knowledge acquisition and dissemination. The Chi-square test statistic is equal to 18.47. Since $18.47 > 3.84$ (df = 1, $\alpha = 0.05$), we reject the null hypothesis and conclude that the number of knowledge-acquisition and knowledge-dissemination messages in virtual communities differs between US and Chinese cultures. The ratio of knowledge dissemination to knowledge acquisition was about 2 to 1 (534/271) in the Chinese virtual communities, and more than 3 to 1 (723/233) in American virtual communities. Americans participate in disseminating knowledge more than Chinese. In other words, the relative proportion of knowledge dissemination to knowledge acquisition is much higher in American virtual communities than in Chinese virtual communities.

The descriptive statistics or summarized results of coding for types of knowledge exchanged in American and Chinese virtual communities are shown in Table I and Fig. 2.

For H5, a Chi-square contingency-table analysis was used to test whether there are differences in the types of knowledge exchanged in American and Chinese virtual communities. The Chi-square test statistic is equal to 21.48 (> 9.49, df = 4, $\alpha = 0.05$), indicating that the null hypothesis is to be rejected. The results suggest that the types of knowledge that were exchanged differ between the two cultures. We carried out further tests to assess the differences between the two cultures regarding the types of knowledge that were shared. The Chi-square statistic (χ^2) for analyzing theoretical versus non-theoretical knowledge messages is 17.42 (> 3.84, df = 1, $\alpha = 0.05$), which shows that there was a difference in the amount of theoretical knowledge exchanged in the virtual communities of the two cultures. Table I shows that Chinese exchanged twice the amount of theoretical knowledge (11% versus 5%) that Americans did in virtual communities. We applied the same

TABLE I
TYPES OF KNOWLEDGE

Messages	Chinese		American	
	Acquisition	Dissemination	Acquisition	Dissemination
Propositional	90 (11.2%)	219 (27.2%)	73 (7.6%)	323 (33.8%)
Descriptive	68 (8.4%)	108 (13.4%)	43 (4.5%)	204 (21.3%)
Historical	5 (0.6%)	12 (1.5%)	9 (0.9%)	17 (1.8%)
Theoretical	11 (1.4%)	75 (9.3%)	3 (0.3%)	48 (5.0%)
Procedural	97 (12.0%)	120 (15.0%)	105 (11.0%)	131 (13.7%)
Subtotal	271 (33.7%)	534 (66.3%)	233 (24.4%)	723 (75.6%)
Total	805 (100%)		956 (100%)	

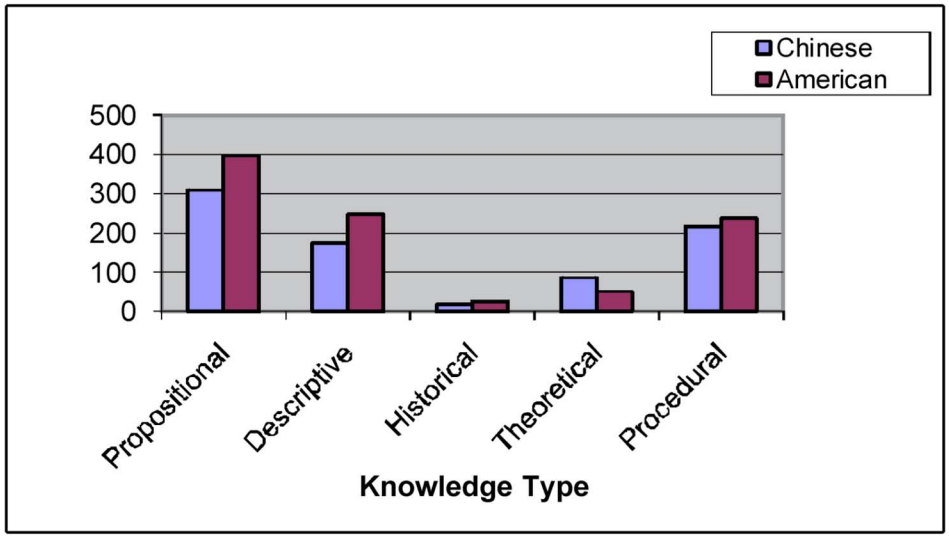

Fig. 2. Knowledge types by culture.

Chi-square analysis to each of the other four types of knowledge—propositional, descriptive, historical, and procedural knowledge. All of them were insignificant at $\alpha = 0.05$. Although Table I shows that Americans exchanged more propositional and descriptive knowledge than did Chinese in the online-community context, the differences are not significant.

In the case of theoretical knowledge, the content in Chinese Yahoo! virtual communities was twice that of American virtual communities. However, the percentages of propositional, descriptive, historical, and procedural knowledge did not differ much between American and Chinese virtual communities, as shown in Table I. We attribute the higher degree of theoretical knowledge exchanged in the Chinese virtual communities to the individualism-collectivism dimension. Chinese are more comfortable sharing theoretical knowledge, which concerns how something is generally or universally accepted or connected with something else.

DISCUSSION

This research examined the effect of national cultures on knowledge sharing in Chinese and American virtual communities hosted by Yahoo!

Eighteen virtual communities in both groups were coded. A total of 3,600 messages were analyzed and coded based on their intentions with regard to acquisition and dissemination of knowledge. They were also coded into five knowledge types—propositional, descriptive, historical, theoretical, and procedural. Hofstede's cultural dimensions served as the conceptual foundation for this research and were used to help derive the research hypotheses.

The research produces some interesting results. First, national culture appears to have an impact on knowledge sharing in virtual communities. The impact can be explained using the two main differences between American and Chinese national cultures—individualism and power distance. Chinese virtual communities appear to participate less in knowledge sharing than American virtual communities. In Chinese virtual communities, there are also fewer knowledge-related messages, particularly knowledge-dissemination messages. Furthermore, a content analysis of the knowledge-dissemination messages (or messages providing solutions to knowledge acquisition) revealed that messages in Chinese virtual communities are usually shorter than those in American virtual communities. Some may argue that the shorter messages are due to inadequate infrastructure, such as low internet speed, but this is unlikely. In China, there are large rural areas where there is no internet access at all, whereas in cities/towns, high-speed internet, rather than dial-up, is prevalent. We can safely assume that most, if not all, of the Chinese virtual-community members have at least acceptable internet-access speed. Does this mean Chinese people are less helpful than American people? The collectivist characteristic in the Chinese national culture provides a possible explanation for the results and observations. Chinese national culture emphasizes personal relationships and prefers a closed system of communication. Hence, they are generally less willing to share knowledge with members of the virtual communities whom they do not know.

The content analysis of the non–knowledge messages in Chinese virtual communities also showed that many messages posted by newcomers to the communities were attempting to establish social contact or build closer relationships with others. These postings may be simply gestures to others or greetings such as "Hello, My name is.... I am new here, will you please help me in the future." This is not surprising because fostering relationships is a characteristic of collectivist societies. For example, the content analysis of the messages showed that Chinese virtual communities' members even met face-to-face to establish relationships. In more mature Chinese virtual communities where a stable community had been formed (e.g., the stock club and the outdoor club), members were more helpful and willing to share knowledge than those in newer Chinese virtual communities. When Chinese virtual communities' members became more familiar or comfortable with one another, they also became more willing to offer help.

In American virtual communities, we found many detailed and long procedural-knowledge-sharing messages in scientific domains such as math, computer hardware, and software. Comparatively, members of Chinese virtual communities had a tendency to provide references or type short messages instead of discussing the knowledge in great detail. Americans are more willing to share their knowledge with others through virtual communities because they have a more open system of communication. In discussions, they are also more likely to openly voice their opinions, elaborate on ideas, and defend their positions.

The large power distance in the Chinese national culture is evident in some Chinese virtual communities, such as those interested in software, programming, math, and physics. These virtual communities had many unanswered knowledge-acquisition messages posted by amateurs or beginners. Even in those cases where the messages were answered, the answers provided were usually very concise. We attribute the observed phenomenon to the cultural dimension of power distance. In Chinese virtual communities, where a high power-distance culture prevails, experts may limit their participation in sharing knowledge with others in order to maintain the power distance. On the other hand, the sense of equality is higher in American virtual communities, where people at all levels, including experts and people of high status, participate actively in contributing knowledge in their areas of expertise. This power-distance argument explains H2, where we found more knowledge-dissemination messages in American virtual communities.

The results also indicate that Chinese virtual communities exchange more theoretical knowledge than American virtual communities. This is in line with Hofstede's findings, which show that Chinese and Americans are positioned on two extremes of the individualism-collectivism continuum.

China scored very high in the collectivism index. Chinese are expected to conform to norms and generally accepted ways of doing things. Thus, the sharing of theoretical knowledge is high because it is important for them to know and to acquire knowledge on how certain things should be done or are generally related. Americans, on the other hand, scored very high in the individualism index. They believe in achieving self-understanding based on one's own actions or thoughts. Thus, they may not be interested in sharing theoretical knowledge. For example, a content analysis of the parenting virtual communities revealed that Chinese members joined the discussions to learn or emulate the parenting behavior of others. They posted theoretical-knowledge messages, such as methods to educate children. On the other hand, the parenting virtual community on the American site contained almost no such category of messages.

CONTRIBUTIONS AND FUTURE RESEARCH

Virtual communities are quickly becoming a part of our lives. Websites and services such as LinkedIn, MySpace, Facebook, and Twitter, among many others, provide some evidence of the importance of establishing social-communication networks involving data, information, and knowledge-dissemination tools in virtual environments [50]–[52]. One of the key objectives of setting up virtual communities is knowledge sharing. As most virtual communities are open to the world, the impact of culture on knowledge sharing in virtual communities becomes an important subject of investigation and an important topic for professional communicators.

The research findings provide support for our hypotheses that national culture has an impact on knowledge sharing in virtual communities. The findings have important implications for researchers and professional communicators. For researchers, this study shows the effect of national culture on virtual communities. Although virtual communities provide a new form of communication and interaction with others, Hofstede's findings on culture are still evident in virtual communities. More research should be conducted to investigate the similarities and differences between virtual communities and traditional communities. This understanding is important to the success of knowledge-management endeavors and efforts.

For professional communicators, this study shows that national culture is an important factor in virtual-community environments. Organizations, whether global or domestic within any given country, can use these results to help cultivate the valued knowledge sharing behaviors in virtual communities. The cultural factor should be taken into account when setting policies related to knowledge sharing and knowledge management, and when implementing knowledge-management systems.

Another contribution of this research for professional communicators is the understanding of the knowledge-acquisition and knowledge-dissemination behaviors in Chinese and American virtual communities. For example, American participants in virtual communities appear more willing to exchange knowledge with those whom they do not know, while Chinese participants are not as willing to share knowledge with strangers. Professional communicators may be able to use this to help design IS and communication systems such as websites or company intranets to overcome cultural barriers [53]–[56].

Another possible implication that can be drawn from this research is that the type of information or knowledge commonly exchanged could be used to help design and deploy systems that better match a company's communication goals [57]. Equipping professional communicators with more insight on how national culture can affect inter- and intraorganizational exchanges of information or knowledge will help them adapt to the internet and globalized world. Furthermore, using these insights, coupled with other communication tools, can create better organizational structures to facilitate information exchange and minimize cultural differences that may exist.

Since virtual communities are growing in importance and popularity, knowledge sharing in virtual communities warrants further investigation and research. A few potential research directions are discussed here. First, does culture (particularly, the individualism-collectivism dimension) influence the exchange of individual versus collective knowledge [46], [58]? Since a high individualism culture, such as American culture, emphasizes self-understanding from the perspective of one's own actions or thoughts, we expect virtual communities in the US to contain more individual knowledge and less social knowledge than Chinese virtual communities. These differences may further impact one's perception of and willingness to participate in a virtual community. Second, we are interested in investigating the effect of virtual communities in mitigating the inherent influence of

culture. Virtual communities differ from physical communities in that communication and sharing of knowledge are non-face-to-face (virtual) and the communication mode is asynchronous. Does the virtual dimension of the communication process minimize the effect of culture in the long run? A longitudinal study to investigate the evolution of knowledge-sharing patterns in Chinese and American virtual communities would be interesting and would complement the existing study. Third, as an extension to this research, a study can be conducted using virtual communities that are created within the context of an organization or association. The effect of corporate culture on knowledge sharing should be understood because knowledge sharing and knowledge management are gaining importance in the corporate and business world [59]. Finally, it would be extremely useful to study the relationships and interactions between national and corporate culture and to examine their combined impact on knowledge sharing and exchange in virtual communities.

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