

# An Empirical Study of Web-based Knowledge Community Success

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## Abstract

*Web-based knowledge communities (WKC)s allow individuals with similar interests to collectively engage in knowledge acquisition and exchange. In spite of increased research interest in the topic of on-line knowledge exchange and social interaction, few studies have identified factors that contribute to WKC success. In this study we apply Preece's community success framework of usability and sociability and the Information System (IS) success model as conceptual foundations for an investigation into the factors that lead to WKC success. We present and empirically test a research model for WKC success using survey data from an IT-related WKC. We find that both usability and sociability factors have a significant effect on user satisfaction which leads to increased sense of community and a greater frequency of WKC usage. This research is one of the first attempts to empirically examine Web-based knowledge community success. The implications for research and practice are also discussed.*

## 1. Introduction

An online community is an emergent form of online collaboration that has become increasingly popular. Online communities utilize computer-mediated communication (CMC) technologies to allow individuals to communicate and stay connected. They are currently being used by millions of people for information sharing, exchange, and collaborative decision making [1]. Online communities can be classified in multiple ways, such as by purpose, type of user, or supporting technologies. The supporting technologies used by online communities have evolved over the years. Online community technologies are no longer limited to listservs, newsgroups, and Intranet portals.

In this paper, we focus on one specific type of online community: Web-based knowledge

communities (WKC)s. We define a Web-based knowledge community as *a community that allows individuals to seek and share knowledge through a website based on common interests*. A WKC is usually centered around a specific knowledge domain and relies on community users as its primary resource for acquiring and exchanging knowledge in order to build a knowledge repository within the community. Unlike listservs or newsgroups which are primarily mediated through email, all communications in a WKC are facilitated through a community website. The contents of WKC)s are publicly available to anyone with Internet access. The number of Web-based online communities has increased considerably in the past few years.

The motivations for this study are three-fold:

First, most of the previous online community studies focused on traditional community technologies such as listservs, newsgroups or corporate knowledge portals [e.g., 2, 3]; few studies have examined WKC)s. As mentioned earlier, WKC)s are unique in many aspects when compared to traditional community technologies; WKC)s have a larger user base, contain richer knowledge content, utilize a pull-based business model, employ multiple communication channels, content search and browsing capabilities, etc. Thus the generalizability of previous research findings to a WKC context is questionable.

Second, researchers have called for more studies on the subject of community success, i.e., what makes a community successful [4]. Most previous online community studies limited their focus to the nature of social interactions and the exchange of knowledge in online communities [e.g., 2, 5-7]. Several studies have begun to examine community success issues, but among these studies, community type, theoretical grounding, and research objectives vary considerably [4, 8-10].

Third, understanding the success factors of WKC)s has major practical implications for WKC

development and sustainability. WKC usage has penetrated many knowledge domains; especially IT related areas where knowledge seeking and exchange has becoming increasingly important for this knowledge-intensive industry. Understanding the critical success factors of WKCs will enable community leaders and developers to assess and improve their current community systems to better serve community users.

Given the limitations of the previous WKC research and the lack of research attention given to WKC success, we sought to fill this gap in the current study by focusing on WKC success. Specifically, we use the IS success model [11, 12] and Preece's community success framework [4] as conceptual foundations for proposing and testing a research model of WKC success. Similar to previous IS success and website success studies, we measure success based on users' perceptions. Specifically, we use self-reported information regarding *user satisfaction*, *sense of community*, and *usage* as the primary community success measures. Our research extends the theoretical understanding of WKC success and offers initial empirical support for the proposed research model. The model can serve as a basis for theory development in future WKC and online community research.

The remainder of the paper is organized as follows. First, we provide the conceptual foundations for this study and present the research model. Next, we describe the research methodology, which explains the data collection and survey administration procedures. Then, we discuss the data analysis and our results. We conclude with a discussion of the implications of this research and suggestions for future research.

## 2. Conceptual Foundation

### 2.1. The IS Success Model

The original IS success model represents one of the first attempts to comprehensively define and evaluate information system success [12]. The original IS success model consists of six distinct information system success factors: system quality, information quality, use (usage), user satisfaction, individual impact, and organizational impact [12]. Recently, due to the dramatic impact that the Internet has had on business operations, the IS success model was refined and adapted to measure e-commerce system success [11]. Service quality was added

to the model in order to recognize the importance of IS support. Also, "individual impact" and "organizational impact" were replaced by "net benefits" in order to capture the balance of the positive and negative impacts of an IS on its end users [11]. Additional research has been conducted to refine and test the IS success model [13, 14].

It has been suggested that future research should apply the IS success model to a variety of settings as there may be different contextual factors that contribute to a system's success [13]. Accordingly, the IS success model has been used as a research framework in other contexts such as website success [15, 16]. Constructs taken from the IS success model, such as information quality, system quality and satisfaction, have been frequently used to assess website success. Since a WKC is a website that collects, processes, stores, displays, and disseminates information among community users, it can be viewed as a Web-based information system consisting of an interconnected set of information resources. Thus, the IS success model offers a theoretical basis on which to evaluate a WKC's success. In this study, we incorporate information quality, system quality, user satisfaction, and use from the IS success model to investigate WKC success. Detailed definitions of these constructs are provided in Section 2.3.

### 2.2. Preece's Community Success Framework

In addition to system and website attributes, a crucial component of a successful WKC is the social interactions among community users. Preece (2001) developed a framework based on sociability and usability to evaluate online communities. We refer to this framework as *Preece's Community Success Framework*. Usability refers to the technical components of the community and is concerned with how intuitive and easy it is for individuals to learn to use and interact with the online community. Sociability focuses on the human-human interaction and is concerned with developing software, policies, and practices to support social interactions online. In essence, usability is concerned with how users interact with technology, and sociability is concerned with how users interact with each other via the supporting technology [4].

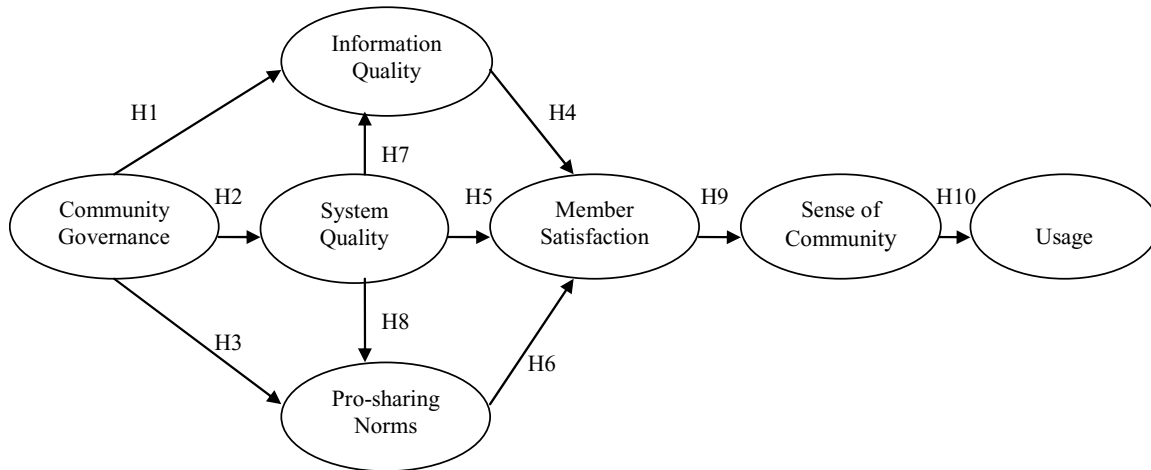
Preece provided some examples of the determinants of usability and sociability through her experience and her research. She suggests

that usability is affected by factors such as information design, navigation, and system quality, and sociability is affected by factors such as user interactions, moderation policies, social relationship development, and trustworthiness [4]. Preece’s community success framework offers a powerful framework for studying WKC success issues. In this study, we incorporate both usability and sociability factors, such as system quality and moderation policies, from Preece’s community success framework.

**2.3. Research Model and Hypotheses**

The IS success model and Preece’s community success framework offer different theoretical lenses through which to study community success. The IS success model is

well-developed in the IS literature and has been evaluated extensively. However, it lacks contextual factors related to community success. Preece’s community success framework, on the other hand, is richer in contextual variables, but the framework is mainly conceptual, and many of the constructs related to community success in the framework need to be further developed and empirically tested. We view these two models as complementary to each other. Some of the proposed variables in Preece’s framework can be integrated with the constructs from the IS success model. Thus, drawing from both the IS success model and Preece’s community success framework, we propose an integrated research model to evaluate WKC success as shown in Figure 1. Table 1 provides formal definitions for each construct in the research model.



**Figure 1 - A research model of WKC Success**

**Table 1. Definitions of Constructs**

Construct	Definition
Information Quality	The value or usefulness of the information contained on the WKC
System Quality	How well a system performs its responsibilities to the users of a WKC
Pro-sharing Norms	The prevalence of norms that are intended to facilitate user participation in a WKC [5]
Community Governance	Rules, guidelines, and moderation policies that guide users' social interaction and cooperation within a WKC
Member Satisfaction	Degree of user satisfaction with the WKC [13]
Sense of Community	Individual's feelings of belonging to a collective that includes others; feeling of identifying with other users in a WKC [19]
Usage	WKC usage [5]

Community governance refers to the rules, guidelines, and moderation policies that govern user behavior. For example, abusive language and inappropriate posts can deter visitors from joining a community and thus affect users' perception of the quality of the community [4]. Therefore, it is imperative for a WKC to implement and administer policies to guide user behavior. With community governance, information posted on the community website is screened, thereby improving the information quality. Users will also perceive a community website with good community standards and policies as possessing higher system quality.

Finally, proper moderation policies will ensure that a WKC is open and friendly to new users irrespective of their origins and backgrounds. Thus we propose the following hypotheses related to community governance.

*H1: Community governance will have a significant positive impact on information quality.*

*H2: Community governance will have a significant positive impact on system quality.*

*H3: Community governance will have a significant positive impact on Pro-sharing norms.*

Information quality refers to the value or usefulness of the information contained on the WKC. It represents the degree to which the quality of the information on the WKC is perceived as high. Information quality typically includes sub-dimensions such as information accuracy, timeliness, completeness, and relevance [15, 17]. Higher information quality will better help fulfill users' information needs, thereby increasing their satisfaction [11-13, 15, 17].

System quality relates to how well the website system performs its responsibilities. System quality includes sub-dimensions such as ease of search, ease of navigation, fast response time, ease of communication with other users, etc. [15, 17]. Higher system quality has been found to be an significant determinant of user satisfaction in the IS literature [11-13, 15, 17]. Since a WKC is also a type of information system, it is reasonable to expect that higher levels of system quality will enable users to accomplish their tasks at hand more quickly, thus increasing users' overall satisfaction.

Pro-sharing norms refer to the norms that are intended to facilitate knowledge sharing in a community [5]. If a community encourages user collaboration and is open to diversity and conflicting views, users will be more likely to interact with one another [5] and feel satisfied. Therefore, we hypothesize the following:

*H4: Information quality will have a significant positive impact on user satisfaction.*

*H5: System quality will have a significant positive impact on user satisfaction.*

*H6: Pro-sharing norms will have a significant positive impact on user satisfaction.*

In addition, we hypothesize that system quality will also positively affect both information quality and pro-sharing norms. If a user finds it easy to use a WKC to navigate, search, or communicate with others, his/her chance of getting the correct information from the WKC for the task will be higher than if he/she were using a cumbersome WKC system. Similarly, we can argue that higher system quality will also have a positive impact on a user's perception of the community's pro-sharing norms since higher system quality will enable community users to more easily interact with each other and help each other, which is favorable for the formation of good community culture and norms. As a result,

*H7: System quality will have a significant positive impact on information quality.*

*H8: System quality will have a significant positive impact on pro-sharing norms.*

Sense of community refers to an individual's feeling of belonging to or identifying with a collective that includes others [18, 19]. This is an attitudinal construct. In order for users to feel a sense of community, they will need to have pleasant experience within a WKC and feel satisfied with the community after they use it [18, 19]. Thus satisfaction can be viewed as an antecedent to sense of community. When users form a positive attitude and feel that they are part of a community, they are more likely to continue to visit the WKC and share their knowledge and experience with other users. Hence, we propose the following relationships:

*H9: User satisfaction will have a significant positive impact on sense of community.*

*H10: Sense of community will have a significant positive impact on usage.*

### 3. Methodology

#### 3.1. Instrument Development

The survey research method was used for data collection in order to increase the generalizability of the results [20]. Table 2 shows the items for each construct and their respective source in the literature.

As can be seen from Table 2, most of the survey items were adopted from previously established measures. However, we could not find appropriate or existing measures for the community governance construct so we developed and tested our own items with a group of expert users. We made modifications and adjustments to the number of items per construct based on practical constraints with the survey length and duration, as well as based on the results of item validation from a pilot test. All questions in the instrument were measured using a seven-point Likert-type scale ranging from “Strongly disagree” to “Strongly agree”.

We chose an information technology (IT)/programming-related WKC for this study. A large portion of the participating WKC’s users are students [21], so we chose to use students as the participants for this study. Most of the participants were enrolled in IT/programming courses and the information contained on the WKC was relevant to the content of their courses and could be useful to them as they completed their programming related assignments. Participation in this survey was voluntary, but extra credit was offered as an incentive for completing the survey. The survey was posted online for a period of three weeks. A subject pool of 231 students was used, from which 199 complete responses were obtained, yielding a response rate of 86 percent.

### 3.2. Survey Administration

**Table 2. Survey Items**

Construct	Item code and description	Source
Information Quality (IQ)	IQ1- Overall, I would give the information from this site high marks in terms of quality.	[17]
	IQ2- Overall, I would give the information provided by this site a high rating in terms of quality.	[17]
	IQ3- In general, this site provides me with high-quality information.	[17]
System Quality (SQ)	SQ1- In terms of system quality, I would rate this website highly.	[17]
	SQ2- Overall, this website is of high system quality.	[17]
	SQ3- In general, I would give a high rating to the system quality of this website.	[17]
Pro-sharing Norms (NORM)	NORM1- It is common to for users to cooperate with each other on this site	[5]
	NORM2- It is common to for users to collaborate with each other on this site.	[5]
	NORM3- The users of this site are open to conflicting views	[5]
Community Governance (CGOV)	CGOV1- it is important that this site has specific rules to guide user behavior.	Self-developed
	CGOV2-It is important that this site has specific policies to guide user behavior.	Self-developed
	CGOV3-It is important that the discussion forums on this site are moderated by forum leaders.	Self-developed
	CGOV4-It is important that the messages posted on this site are regulated.	Self-developed
Member Satisfaction (SAT)	SAT1- I am satisfied with this site.	[15]
	SAT2- I am pleased with this site.	[15]
Sense of Community (SOC)	SOC1- I feel as if I belong to this community.	[19]
	SOC2- I feel as if I am socially connected to this community.	[19]
	SOC3- I feel as if I am a part of this community.	[19]
Usage (USE)	USE1- I frequently use this site.	[5]
	USE2- I often use this site.	[5]

#### 4. Data Analysis and Results

We first assessed the reliability and validity of the construct measures. Then, structural equation modeling using Amos 6 was used to evaluate the relationships between the indicators and latent constructs shown in Figure 1.

##### 4.1. Measurement Model

The test of the measurement model included the estimation of internal consistency (reliability) and the convergent and discriminant validity of the instrument items.

The constructs were assessed for reliability using Cronbach's alpha. It has been suggested that a value of at least 0.70 or above indicates adequate reliability [22]. The reliabilities of the constructs were all above 0.80 which indicates good reliability and internal consistency (Table 3). The self-developed measure of community governance also demonstrated good reliability with an alpha of 0.87.

**Table 3. Reliability of Constructs**

Construct	Cronbach's Alpha	Average Variance Extracted (AVE)
Information Quality	0.92	0.79
System Quality	0.94	0.85
Pro-sharing Norms	0.82	0.61
Community Governance	0.87	0.64
Satisfaction	0.91	0.83
Sense of Community	0.93	0.83
Usage	0.96	0.92

To test for convergent validity, the average variance extracted (AVE) was calculated for each construct. The value of the AVE for each construct is shown in Table 3. As can be seen in Table 3, each AVE value is above the recommended level of 0.50 [23], which indicates good convergent validity of the items in each construct.

For satisfactory discriminant validity, the AVE from a construct should be greater than the variance shared between the construct and the other constructs in the model [24]. Table 4 shows the correlation matrix of the correlations between all the constructs. The bolded diagonal elements in Table 4 are the square root of each construct's AVE. In all cases, the square root of the AVE is larger than the correlation of that construct with all the other constructs in the model, thereby indicating satisfactory discriminant validity.

Discriminant and convergent validity are further confirmed when individual items load above 0.50 on their associated factors and when the loadings within a construct are higher than those across constructs. All items loaded on their constructs as expected. Furthermore, all items loaded more highly on their intended construct than they loaded on any other construct; and in all cases, the differences were greater than 0.10.

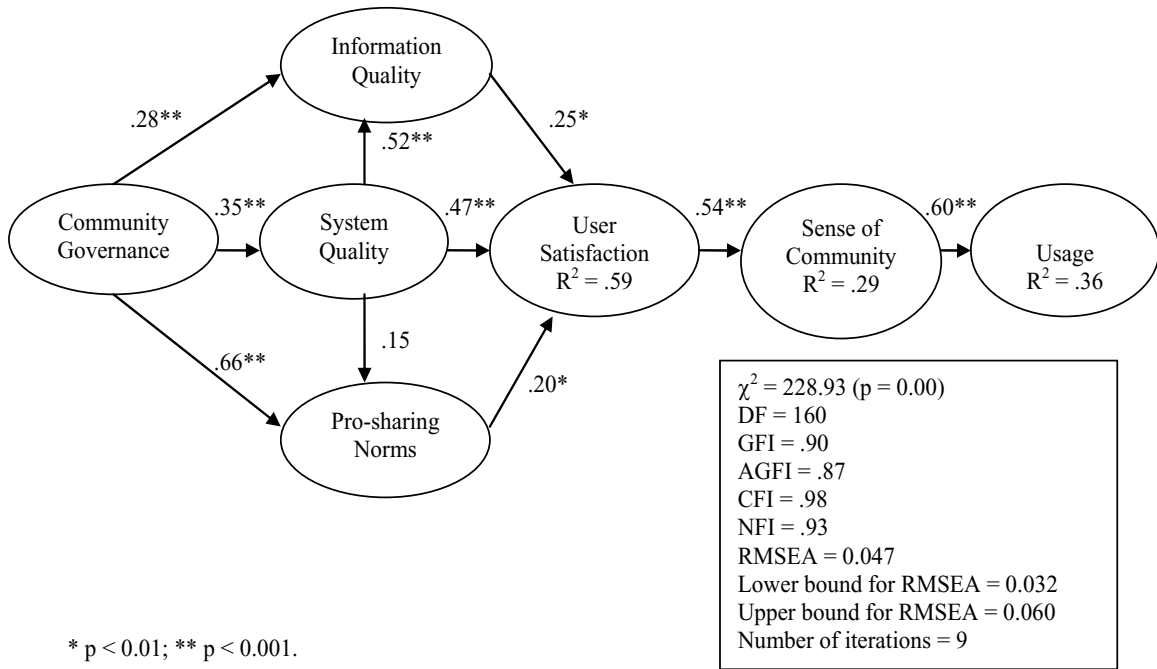
##### 4.2. Structural Model

The test of the structural model includes estimates of the path coefficients, which indicate the strength of the relationships between the dependent and independent variables; and estimates of the R<sup>2</sup> values, which represent the amount of variance explained by the independent variables. Together, the R<sup>2</sup>'s and the path coefficients (loadings and significance) indicate how well the data support the hypothesized model.

AMOS 6 [25] was used to test the structural model. Figure 2 contains the fit statistics and estimates of path coefficients for the structural model. The fit estimates indicated that the model meets all of the acceptable fit index thresholds for IS research [26]. For example, the GFI is 0.90 which is the recommended threshold for good fit. The AGFI is well above the recommend minimum value of 0.80, suggesting good model fit [27]. The root mean square error of approximation (RMSEA) is 0.047 which is well below the threshold of 0.08, which indicates good model fit after adjusting for the large sample size [28].

**Table 4. Convergent and Discriminant Validity**

	Community Governance	Pro-sharing Norms	System Quality	Information Quality	Satisfaction	Sense of Community	Usage
Community Governance	<b>0.80</b>						
Pro-sharing Norms	0.66	<b>0.78</b>					
System Quality	0.45	0.38	<b>0.92</b>				
Information Quality	0.51	0.38	0.64	<b>0.89</b>			
Satisfaction	0.47	0.48	0.71	0.63	<b>0.91</b>		
Sense of Community	0.25	0.26	0.38	0.34	0.54	<b>0.91</b>	
Usage	0.15	0.15	0.23	0.20	0.32	0.60	<b>0.96</b>



**Figure 2. AMOS Results for WKC Success Model**

**4.3. Hypothesis Testing**

All but three of the path coefficients between the latent constructs were significant at  $p < 0.001$ . The only insignificant path was between system quality and pro-sharing norms.

The percent of variance explained by the model as it relates to user satisfaction, sense of community, and usage were 0.59, 0.29, and 0.36 respectively. These values are reasonably high, which provides confidence that the proposed research model has a fairly high degree of explanatory power.

**Table 5. Hypothesis Testing Results**

IV \ DV	Information Quality	System Quality	Pro-sharing Norms	User Satisfaction	Sense of Community	Usage
Community Governance	H1 Supported**	H2 Supported**	H3 Supported**			
Information Quality				H4 Supported*		
System Quality	H7 Supported**		H8 Not Supported	H5 Supported**		
Pro-sharing Norms				H6 Supported*		
User Satisfaction					H9 Supported**	
Sense of Community						H10 Supported**
Usage						

\* p < 0.01; \*\* p < 0.001.

All except for one of the proposed hypotheses were supported (Table 5). There is an insignificant relationship between system quality and pro-sharing norms which indicates that users' perception of the website system quality does not affect how they perceive the pro-sharing norms within the community.

Community governance significantly affects information quality, system quality, and pro-sharing norms. User satisfaction is affected by information quality, system quality, and pro-sharing norms individually. Users' perception of the website system quality impacts their perception of information quality, which indicates that as system quality increases, users are more likely to believe that they are finding high quality information on the site.

User satisfaction significantly impacts users' sense of community which subsequently affects users' usage of the community. This indicates that as users become more content with the community, they are more likely to feel belonging to the community and increase their usage of the community. If they are more likely to identify with other users and feel like a part of the community, they are more likely to return and continue using the community.

## 5. Discussions

### 5.1. Implications for Research

The purpose of this study was to propose and test a research model for Web-based knowledge community success. This research

represents one of the first attempts to evaluate Web-based knowledge communities or online communities in general and to investigate success issues. This research enriches our theoretical understanding of WKC success. Building upon the IS success model and Preece's community success framework, we proposed and tested an integrated research model of WKC success. We identified important factors and tested their relationships with each other and with the dependent variables. This study raises implications for future research in the online community success research domain.

This research extends previous research by incorporating variables from the IS success model which have not been applied directly before to WKC or online community success research. A Web-based knowledge community can be viewed as a website, a web-based information system, and a community. It is a new form of communication whereby community users share knowledge for mutual learning or problem solving and conduct social interactions. As a website, system quality is important to ensure user satisfaction and participation. As a Web-based information system, information quality is a key component as the purpose of a WKC is knowledge acquisition and exchange. Without high quality information, users are less likely to feel satisfied with the community and to continue using it. Information quality and system quality together form usability factors as in Preece's community success framework.

Using a sociability perspective, we identified three important factors in WKC

success: community governance, pro-sharing norms, and sense of community. Community governance is a unique construct that we developed for the online community research area. It represents the rules, policies, and moderation implemented to ensure proper user behavior. This study measured community governance by creating custom measures that proved to be reliable and therefore could be used in future research. Community governance was demonstrated to be an important antecedent for information quality, system quality and pro-sharing norms.

Pro-sharing norms had not previously been tested or applied in a WKC setting to evaluate WKC success. We utilized previously established measures to evaluate pro-sharing norms and its effect on WKC user satisfaction. This study also represents one of the first attempts to utilize sense of community as a dependent construct for evaluating WKC success. As users become satisfied with a community, they are more likely to feel a sense of belonging to the community and identify with other users in the community. This will enhance their participation and communication with other users which in turn increases their usage.

## 5.2. Implications for Practice

The primary purpose of a WKC is knowledge acquisition and exchange. This research raises practical implications for community leaders and developers to consider. From a usability perspective, community developers should focus on improving the website system attributes that are desirable for user participation. As indicated by our results, system quality significantly affects information quality. By designing a functional and easy to use website, community developers are more likely to attract users to join a community and share their knowledge with other users using the features provided by the community website, such as discussion forums and online chatting tools.

Community leaders should also take community governance into consideration when implementing community management practices. Without rules, policies, and moderation techniques in place, user discussions can become disorganized or even chaotic. Rules such as required registration may help manage membership and deter uncivilized behavior. Rules and policies should be set up to enhance

good community spirit among users. In addition, community leaders should promote pro-sharing norms within the community to encourage user participation. One way to encourage knowledge sharing is by forming groups of users with similar interests. This will promote more collaboration among users. Another way to promote knowledge sharing is by offering incentives. Incentives such as bonus points and recognition for frequent contributors can encourage knowledgeable users to share their expertise with novice users. Rewards and recognition can boost user participation which subsequently enhances the pro-sharing norms in the community.

## 5.3. Limitations and Suggestions for Future Research

This research is not without its limitations. WKC success or online community success is affected by many factors. This study may not have captured all the factors that contribute to WKC success. In order to keep the research model parsimonious, we identified important usability and sociability factors to be tested as independent variables to measure WKC success. Future research can expand upon the proposed research model and may uncover possible additional factors and relationships.

There are also different measures of WKC success that could be investigated and perhaps added to the model tested in this research. We used some common measures (user satisfaction and self-reported use), but there are other measures that could be investigated, including objective measures of use obtained from server logs. Due to practical considerations we limited our success measures to the ones discussed in this paper.

Our study used students for the survey sample. Although students are a major user group of the participating WKC, there may be response bias because we did not sample other types of community users. Future study can enhance the external validity and generalizability of the results by surveying other categories of community users such as IT professionals and hobbyists.

Finally, in this study, we only focused on one IT/programming related WKC. This limits the external validity and generalizability of the results. There are other types of WKCs established for other purposes. Future research can test the research model under different

contexts to confirm and contrast the results. The research model can be modified and adapted for other types of social online communities as well. This in turn will enhance the generalizability of the research model.

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