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How Loyal Are You? Continuance Intention and Word of Mouth in Free/Libre Open Source Software

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ABSTRACT

Free/Libre Open Source Software (FLOSS) has begun to attract increasing numbers of non-technical end-users. Drawing upon information systems (IS) post-adoption research and other relevant research including IS success, consumer behavior, and FLOSS, the current proposed study will open a necessary but unexplored new research agenda: non-technical end-users' continued FLOSS usage behaviors and examine the phenomenon by proposing a model. The study will further examine the proposed model by comparing two distinct user populations (i.e., regular loyal users vs. dedicated loyal users), and identify the factors that are more prominent in the dedicated loyal user population. The research will also conduct a case study on an exemplary community-led marketing campaign (i.e., Spreadfirefox.com) to examine how the practice of word of mouth is made more effective through its dedicated loyal users' active contributions. In addition to its theoretical contribution to FLOSS research, the research will generate a range of practical implications for FLOSS communities as to how they can achieve a much stronger loyal user base and benefit from their contributions.

Keywords

Free/Libre Open Source Software (FLOSS), post-adoption behavior, user loyalty, user satisfaction, word of mouth, community-led marketing.

INTRODUCTION

Over the last several decades, Free/Libre Open Source Software (FLOSS) emerged as one of the most promising phenomenon in the software industry, and now it has evolved not only as a mainstream approach to software development but also as a driving force towards an open movement that is permeating our society at several levels and in several different domains, including open courseware and open scientific publication. Of special account in the FLOSS trend is the fact that given more awareness among the general public bolstered by the recent popularity of some successful FLOSS such as Firefox, the user base of FLOSS became more heterogeneous. Unlike the early stages in the FLOSS evolution when FLOSS was made mostly by and for developers, recent statistics indicate that FLOSS has started rapidly attracting increasing numbers of non-technical end-users (Choi and Chengalur-Smith, 2009).

Despite its increasing significance, however, the research to date has heavily focused on development rather than use and technical developers rather than non-technical end-users, and was conducted mostly at the organizational level rather than at the individual level (Jin et al., 2007). Only a handful of studies have been carried out pertinent to this emerging research area such as 1) usability for end-users (e.g., Nichols & Twidale, 2003), 2) community-led marketing (e.g., Krishnamurthy, 2009), 3) the adoption and use of FLOSS by end-users (e.g., Huysmans et al., 2008), 4) end-users' switching behavior to FLOSS (Ye et al., 2008). Furthermore, although many already adopted and have been using numerous different FLOSS, no study has been conducted with respect to end-users' continued FLOSS usage behaviors.

Drawing upon information systems (IS) post-adoption research and other relevant research including IS success, consumer behavior, and FLOSS, the current study will first propose a model that investigates non-technical end-users' continued FLOSS usage behaviors: how users' perceived behavioral, normative, and ideological benefits about using FLOSS affect user satisfaction which in turn affects user loyalty to FLOSS that consists of continuance intention and word of mouth, and finally how continuance intention affects word of mouth (see, Figure 1). Then, by applying the proposed model to two distinct

populations (i.e., regular loyal users vs. dedicated loyal users)¹, the study will further investigate what factors are more prominent in the dedicated loyal user population. Lastly, an exemplary instance of the practice of word of mouth in an online FLOSS user community website (i.e., Spreadfirefox.com) will be examined using a case study approach to investigate how the practice of word of mouth is made more effective through its dedicated loyal users' active contributions.

The current proposed study will have theoretical as well as practical contributions. First, the study will open a necessary but unexplored new research agenda (i.e., non-technical end-users' continued FLOSS usage behaviors) and will provide a model drawn upon IS post-adoption research and other relevant research for the field of FLOSS. Considering that most FLOSS projects suffer from a lack of marketing resources, it seems to be critical for FLOSS communities to understand the factors that are more prominent in the dedicated loyal user population and how they actually perform a practice of word of mouth which is likely to result in attracting more new users. In these regards, the study will further examine the proposed model by comparing two distinct user populations (i.e., regular loyal users vs. dedicated loyal users), and identify the factors that are more prominent in the dedicated loyal user population. The research will also conduct a case study on an exemplary community-led marketing campaign (i.e., Spreadfirefox.com) to examine how the practice of word of mouth is made more effective through its dedicated loyal users' active contributions. In addition to its theoretical contribution to FLOSS research, therefore, the research will generate a range of practical implications for FLOSS communities as to how they can achieve a much stronger loyal user base and benefit from their contributions.

The organization of the paper is as follows. The next section reviews theoretical foundations in the relevant research areas. Subsequently, the third section develops an integrated model of non-technical end-users' continued FLOSS usage behaviors and proposes relevant research hypotheses. The detailed research design is described in the fourth section. Finally, the paper provides a conclusion.

THEORETICAL FOUNDATIONS

While traditional IS adoption research such as technology adoption model (TAM) (e.g., Davis et al., 1989) and innovation diffusion studies (e.g., Rogers, 1983) have enhanced our understanding of the determinants of initial adoption and have provided a theoretical basis for the early post-adoption research that viewed continued usage as an extension of initial adoption. However, the current literature on IS post-adoption research views continued usage as a more conceptually distinct issue from initial adoption, and thus suggests that it should be regarded as an independent topic. Accordingly, constructs such as expectation and confirmation from the consumer behavior literature (e.g., Anderson and Sullivan, 1993), perceived benefits from the psychological literature (e.g., Karahanna et al., 1999), use and user satisfaction from the IS success and consumer behavior literature (e.g., DeLone and McLean, 2003), loyalty from the marketing literature (Gefen, 2002) have been explored and incorporated into various models that attempt to predict users' continued usage.

By following the tradition of IS adoption research that emphasizes individual cognitions, Karahanna et al. (1999) examined differences in individuals' pre-adoption and post-adoption beliefs (i.e., behavioral beliefs such as perceived usefulness, image, compatibility, perceived ease of use, visibility, result demonstrability, and trialability; normative beliefs such as top management, supervisor, peers, friends, MIS department, and local computer specialists) about using Windows technology in a single organization. The findings from the study suggest that unlike potential adopters, current users' continuance intention is more affected by variables such as perceived usefulness, image, peers, local computer specialists, top management, and supervisor. While some variables are only applicable at the organizational level, the study provides post-adoption research including the current study with a theoretical framework to better understand users' post-adoption behaviors (continued usage) from the individual cognitive perspective (i.e., perceived beliefs about using the IS). Therefore, the variables² in this study (Karahanna et al., 1999) that are closely relevant to non-technical end-users' continued FLOSS usage behaviors are incorporated into the proposed model by the current study (see, Figure 1) and further discussed in the research model section. Another important construct that should be also considered is ideological benefits. As briefly mentioned in the introduction

¹ In the model proposed by the current study (see, Figure 1), both are defined as loyal users. To examine the factors that are more prominent in the dedicated loyal user group, however, they are divided into the two different groups: the users who participate in and contribute to Spreadfirefox.com (i.e., dedicated loyal users) and the users who continue using Firefox, but do not participate in Spreadfirefox.com (i.e., regular loyal users).

² Individuals' perceived benefits are defined as the determinants of their attitudes in most adoption research. However, since the model proposed by the current study is built on the assumption of their direct relationship and do not include the attitude construct, the word, 'benefits,' is substituted with a word, 'benefits,' as appeared in Kim and Son (2009).

section, FLOSS itself reflects ideological beliefs that play an important role to engage potential contributors and users with FLOSS movement (Hars and Ou 2002; von Krogh, 2003; Stewart and Gosain, 2006).

Notably, a recent study by Kim and Son (2009) has further extended the current post-adoption research by developing and testing a dual model that explains post-adoption behaviors in the context of online services. More specifically, drawing upon a dual model of relationship maintenance in consumer behavior research, the study found that continued usage reactions (i.e., benefits, attitude, intention, and behaviors) are driven mainly by two contrasting mechanisms (i.e., dedication-based and constraint-based) and their interplays. While the dedication-based mechanism centers on the concept of loyalty and describes its relationships with perceived benefits (perceived usefulness and satisfaction) and dedication-based outcomes (usage intention and word of mouth), the constraint-based mechanism centers on the concept of switching cost and illustrate its relationships with service-specific investments (personalization and learning) and constraint-based outcomes (willingness to pay and inattentiveness to alternatives). With respect to the current proposed study, the dedication-based mechanism offers a more relevant theoretical foundation since most FLOSS geared towards non-technical end-users rarely involve switching cost issues (e.g., personalization, learning, or monetary payment, etc). Moreover, the dedication-based model includes the concepts of loyalty and word of mouth as constructs, and thus it provides a perfect theoretical framework to examine how to increase FLOSS adoption by loyal users' word of mouth practice, which will be also one of the most important contributions of the current proposed study.

The concept of word of mouth has been extensively examined and is considered one of the most important construct in consumer marketing research (e.g., Reichheld, 2003). It theorizes that the more satisfaction a user experiences from the product or service, the more s/he will recommend it to her or his contacts through positive word of mouth. As discussed, this practice of word of mouth by dedicated loyal users is especially pertinent to the case of FLOSS adoption, again, considering the fact that most FLOSS projects suffer from a lack of marketing resources. Only a handful of studies to date have looked into its importance for FLOSS success (i.e., Jin & Robertson, 2008; Krishnamurthy, 2009). While they clearly direct more attention to the practice and provide insights into its importance, none of them examines its dynamics systematically.

User satisfaction has been also one of the core constructs in IS success research, and many IS post-adoption research employed them due to their intuitive direct relations to users' continuance intention (e.g., Taylor and Todd, 1995). In FLOSS research, Crowston et al. (2006) has applied the DeLone and McLean model of Information System success (DeLone and McLean, 1992; 2002; 2003) to examine FLOSS success determinants and indicated user satisfaction as an important factor which will drive others to adopt the software, and thus lead the project to success.

RESEARCH MODEL

Figure 1 depicts a model that the current study proposes for examination of post-adoption phenomena in the context of FLOSS for non-technical end-users. The model builds on the literature introduced in the theoretical section as well as a pilot study³ conducted to identify FLOSS specific variables. As shown, the major theme of the model is to examine how users' behavioral, normative, and ideological benefits about using FLOSS affect user satisfaction which in turn affects user loyalty to FLOSS, and finally how continuance intention affects word of mouth. This section provides a theoretical rationale for the model and proposes research hypotheses.

Behavior benefits

Although TAM (Davis et al., 1989) was originally developed to predict users' initial adoption intention, a number of post-adoption studies have examined the effect of its two most prominent components (i.e., perceived usefulness and perceived ease of use) on user satisfaction which in turn affects continued usage, and have found that they are also important determinants to predict users' continuance intention (e.g., Kim and Malhotra, 2005; Konana and Balasubramanian, 2005; Lederer et al., 2000). In addition to these two prominent factors (i.e., perceived usefulness and perceived ease of use) in IS adoption research, the propose model includes a relatively new construct: perceived security, which is considered to be an important indicator in Web-based information systems (Ye et al., 2008). In the pilot study mentioned above, about 30% of the students also indicated that perceived security is an important factor that affects their continuance intention for Firefox. Therefore, the study hypothesizes that:

³ 30 undergraduate students in an introductory information technology class were asked to use Firefox for a month and submit a report about their continuance intention and its determinants.

H1: Perceived usefulness of FLOSS will be positively related to user satisfaction.

H2: Perceived ease of use of FLOSS will be positively related to user satisfaction.

H3: Perceived security of FLOSS will be positively related to user satisfaction.

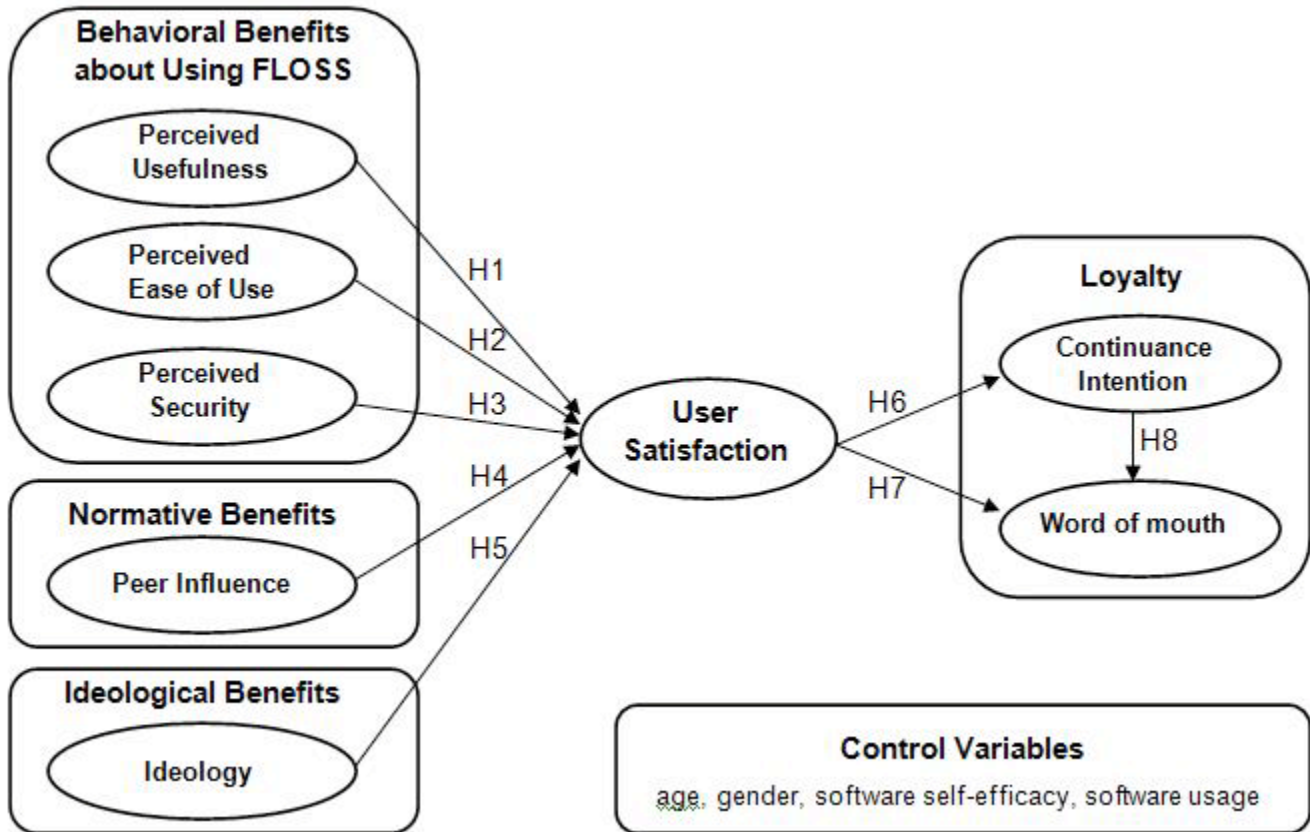


Figure 1. Proposed Research Model

Normative benefits

As Rogers (1976) pointed out, the importance of social influence in the innovation diffusion process cannot be overemphasized. Since FLOSS is regarded as a social movement rather than just a new software development paradigm, and social influence takes place in a circumstance where individuals try to conform to the expectation of others, its importance becomes even greater than in any other contexts. While it seems to be more pertinent to the initial adoption phenomenon according to the innovation diffusion theory perspective, some studies have found that it also affects users' post-adoption behaviors (e.g., Karahanna et al., 1999). Moreover, despite its intuitively relevant linkage to FLOSS as discussed above no study has examined its effect on users' continuance intention through user satisfaction. Therefore, the study hypothesizes that:

H4: Peer influence will be positively related to user satisfaction.

Ideological benefits

A stream of research in FLOSS has focused on identifying motivations for developers and users who voluntarily participate in FLOSS communities with little or no monetary compensation (e.g., Hars and Ou, 2001; von Krogh et al., 2003; Mockus et al., 2002). Further, this unique aspect of FLOSS has led the researchers to question how these communities facilitate

collaboration without the formal control or coordination that guide the traditional software development practice. Several studies have found that the ideology functions as one of the most critical factors at various levels of FLOSS development and adoption (e.g., Gallivan, 2001; Scacchi, 2002; Stewart and Gosain, 2006). Following the findings from this line of research in FLOSS, it can be inferred that ideology affects users' continuance intention through increased user satisfaction. Considering that one's ideological belief cannot be changed easily, it is likely to continuously influence one's behaviors. Therefore, the study hypothesizes that:

H5: *Ideology will be positively related to user satisfaction.*

User satisfaction

A number of studies in consumer behavior and post-adoption research have found that user satisfaction has a positive effect on users' loyalty (i.e., continuance intention and word of mouth practice) (e.g., Anderson, 1998; Mittal and Kamakura, 2001; Wangenheim and Bayón, 2007). Since non-technical FLOSS end-users are thought of as an important resource (e.g., marketing) for FLOSS success beyond just being consumers of the product, the effect of their satisfaction level on their dedication level becomes even more important. Therefore, the study hypothesizes that:

H6: *User satisfaction will be positively related to continuance intention.*

H7: *User satisfaction will be positively related to word of mouth.*

Loyalty

Loyalty is largely defined as an individual's dedication or commitment toward a product or service in consumer behavior research (Oliver 1999). Recently, it has gained enormous attention from online consumer marketing researchers due to their realization of the significant impact of recommendations or support from loyal customers on a firm's vitality (Kim and Son, 2009; Reichheld, 2003; Valck et al., 2009). As discussed, given that most FLOSS projects suffer from a lack of marketing resources, it becomes even more critical for FLOSS communities to understand the factors that are more prominent in the dedicated loyal user population. In addition, the notion that while some loyal users do not practice word of mouth while others actively do, leads the current study to first hypothesize whether a loyal user's higher continuance intention will be positively related to her or his practice of word of mouth. The differences among these two groups (i.e., regular loyal users vs. dedicated loyal users) will be further examined through a case study. Therefore, the study hypothesizes that:

H8: *Continuance intention will be positively related to word of mouth.*

Control variables

The widely adopted control variables in IS pre- and post-adoption research such as age and gender (e.g., Venkatesh et al. 2003), software self-efficacy (e.g., Jaspersen et al. 2005), software usage (Szajna, 1996) are incorporated into the proposed model to eliminate any potential bias that is found to be caused by these factors (Kim and Son, 2009).

Finally, Table 1 shows the definitions and expected sample items of each construct in the model proposed by the current study.

RESEARCH DESIGN

Phase I: Measure development and refinement

All variables will be measured at the individual level (i.e., non-technical FLOSS end-users), more specifically, Firefox users. First, the initial scale measures will be developed mainly based on existing scales that have been empirically proven to be reliable and valid in previous studies (see Table 1), and also from the results of the pilot study that was conducted to identify FLOSS specific variables. After ensuring their face and content validity, another pilot test will be conducted using Firefox users: student users who represent regular loyal users and users who contribute to the Spreadfirefox.com community who can be considered dedicated loyal users. Based on the feedback from the second pilot test, the questionnaire will be further refined.

Phase II: Data Collection

The finalized questionnaire will be distributed to both student users who represent regular loyal Firefox users and users who contribute to the Spreadfirefox.com community who can be considered dedicated loyal users to solicit their participation. Finally, to examine how the practice of word of mouth is made more effective by its dedicated loyal users' active contributions. The forum posting data will be collected from the Spreadfirefox.com website and content-analyzed using a case study approach.

Construct	Definition	Source
	Expected Sample Item	
Perceived Usefulness	The degree to which using an IS enhances effectiveness	Kim and Son (2009)
	Using Firefox improves my performance.	
Perceived Ease of Use	The degrees to which using an IS is free of effort	Karahanna et al. (1999)
	Using Firefox is free of effort	
Perceived Security	The degree to which using an IS is safe	Ye et al. (2009)
	Firefox is a secure Web browser through which to send information	
Peer Influence	The degree to which peers think the user should use an IS	Karahanna et al. (1999)
	My peers think I should use Firefox	
Ideology	The degree to which the user sticks to the benefits on an IS	Stewart and Gosain (2006)
	I believe FLOSS helps other people	
User Satisfaction	The degree to which the user thinks using an IS meets her or his expectation	Kim and Son (2009)
	What I get from using Firefox meets what I expect for this type of software.	
Continuance Intention	The degree to which the user thinks s/he continues using an IS	Wang and Chiang (2009)
	I intend to continue using Firefox	
Word of Mouth	The degree to which the user intends to recommend an IS to others	Kim and Son (2009)
	I will say positive things about Firefox to other people	

Table 1. Construct Definition and Expected Sample Item

Phase III: Data Analysis

The data obtained from the student users through the questionnaire will be first analyzed to examine all the hypotheses in the proposed model: how users' perceived behavioral, normative, and ideological benefits about using FLOSS affect user satisfaction which in turn affects user loyalty to FLOSS which consists of continuance intention and word of mouth, and finally how continuance intention affects word of mouth (see, Figure 1). Then, to further investigate the factors that are more prominent in the loyal users' population, the results will be compared to the findings obtained from the Spreadfirefox.com users by using the same questionnaire. Finally, the forum posting data collected from the Spreadfirefox.com website will be content-analyzed to further examine how the practice of word of mouth is made more effective through its dedicated loyal users' active contributions.

CONCLUSION

The most important contribution of the current proposed study will be that it will open a necessary but unexplored new research agenda: non-technical end-users' continued FLOSS usage behaviors. The study will provide a model drawn upon IS post-adoption research and other relevant research including IS success, consumer behavior, and FLOSS. The model will be examined and is expected to offer rich theoretical and practical implications for understanding what constitutes non-technical end-users' continued FLOSS usage intention and loyal users' practice of word of mouth. Even if any hypothesis in the model

turns out to be not significant, the study will still provide implications to guide future research about what needs (or not) to be further examined. Another important contribution is that the study will examine the model by comparing two distinct user populations (i.e., regular loyal users vs. dedicated loyal users), and identify what factors are more prominent in the dedicated loyal user population. The research will also conduct a case study on an exemplary community-led marketing campaign (i.e., Spreadfirefox.com) to examine how the practice of word of mouth is made more effective through dedicated loyal users' active contributions. In the course of observations, the study will generate a framework to analyze the practice of word of mouth, which itself can be regarded as another contribution to FLOSS research. Finally, the analysis of practice that is considered effective will yield a range of practical implications for FLOSS communities as to how they can achieve a much stronger loyal user base and benefit from their contributions.

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