

EFFECT OF USER EXPERIENCE ON TECHNOLOGY ACCEPTANCE: THE CASE OF FOSS

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ABSTRACT

Free and open source software (FOSS) movement essentially arises like answer to the evolution occurred in the market from the software, characterized by the closing of the source code. Furthermore, some FOSS characteristics, such as (1) the advance of this movement and (2) the attractiveness that contributes the voluntary and cooperative work, have increased the interest of the users towards free software. Traditionally, research in FOSS has focused on identifying individual personal motives for participating in the development of a FOSS project, analyzing specific FOSS solutions, or the FOSS movement itself. Nevertheless, the advantages of the FOSS for users and the effect of the demographic dimensions on user acceptance for FOSS have been two research topics with little attention. Specifically, this paper's aim is to focus on the influence of the user experience with FOSS the FOSS acceptance. Based on the literature, user experience is an essential demographic dimension for explaining the Information Systems acceptance. With this purpose, the authors have developed a research model based on the Technological Acceptance Model (TAM).

RESUMEN

El movimiento asociado al software de código abierto (FOSS) surge como una respuesta a la evolución acontecida en el mercado del software, caracterizado por el cierre del código fuente. Además, algunas características del FOSS como (1) el avance de este movimiento y (2) el atractivo que suscita debido a que se construye bajo la filosofía de trabajo voluntario y cooperativo, ha incrementado el interés de los usuarios hacia FOSS. Tradicionalmente las investigaciones en FOSS han estado centradas en identificar las motivaciones personales de participar en el desarrollo de un proyecto FOSS. Mientras que las ventajas del FOSS para los usuarios y el efecto de las dimensiones demográficas en la aceptación de FOSS han sido dos tópicos de investigación con poca atención. Concretamente, este artículo se centra en analizar la influencia de la experiencia con FOSS en la propia aceptación de FOSS. Basado en la literatura, la experiencia del usuario es una dimensión demográfica esencial para explicar la aceptación de los Sistemas de Información. Con este propósito, los autores han desarrollado un modelo de investigación basado en el Metamodelo de Aceptación de la Tecnología (TAM).

1. INTRODUCTION

From a professional, academic, business and political standpoint, few topics are as current as the development and implementation of free and open source software (FOSS). The changes introduced by FOSS in the software industry have been surprising, and represent a radical change of perspective in developmental business models and software distribution. This change has turned FOSS into one of the most debated topics among software users and analysts Fuggetta (2003).

In recent years, FOSS use has rapidly grown among organizations and users, thanks to the advantages that it offers when compared to proprietary software (Ruffin and Ebert, 2004). As a consequence of its evolution, a great amount of research has been done on FOSS. Traditionally, this research has focused on, either the identification of the personal motives of the people who participate in the development of an FOSS project (Bonaccorsi and Rossi, 2003; Hertel et al., 2003; Ye and Kishida, 2003; Hars and Ou, 2002; and Ryan and Deci, 2000), the analysis of specific solutions that are developed by the FOSS movement (Federman,2006; Fink, 2003; Franke and Von Hippel, 2003; Mustonen, 2003; and Garbone and Stoddard, 2001), or on the FOSS movement, itself (Shen, 2005; Van Wendel and Egyedi, 2005; Dwan, 2004; Bonaccorsi and Rossi, 2003; Fuggetta, 2003; Krishnamurthy, 2003; Lakhani and Von Hippel, 2003; West, 2003; Johnson, 2002; Scacchi, 2002)

However, the profile of the FOSS user or the influence of the demographic dimensions the acceptance towards this software solution has received very little attention. For this reason, our purpose is to analyze the effect of the user experience on the acceptance for FOSS. User experience is one of the essential demographic dimensions for explaining the Information Systems acceptance. For this development, we have considered the Technology Acceptance Model (TAM) (Davis, 1989) which provides the theoretical and methodological framework capable of explaining the acceptance for FOSS. With this objective in mind, we have carried out a study on users of the Linux operating system. We consider that the TAM application for users of the Linux Operative System serves as a representative sample of potential FOSS users. Thus, we understand that the conclusions reached from our specific study will allow to uncover the factors that influence user acceptance of any technology based on FOSS.

2. TAM METHODOLOGY AND HYPOTHESIS

The TAM model developed by Davis (1989) has been widely applied with the purpose of understanding the conduct and motivational factors that influence Information Systems and Technologies (IS/IT) adoption and use. Just as Venkatesh and Davis (2000) indicate, only ten years after the model publication, the Social Science Citation Index listed more than four-hundred articles that had cited both articles which introduced TAM methodology, Davis (1989) and Davis et al. (1989). Since then, the model has become well established as a powerful and efficient tool for predicting user acceptance.

The TAM model is an adaptation of the Theory of Reasoned Action (TRA) proposed by Fishbein and Ajzen (1985) to explain and predict the behaviour of organizational members in specific situations. TAM adapts the TRA model to provide evidence for the general factors that influence IS/IT acceptance in order to help determine user behaviour towards a specific IS/IT. This powerful model allows for a contrast in behaviour on the part of the user and is based on four fundamental variables or constructs which are: perceived usefulness (PU), perceived ease of use (PEU), intention to use (IU) and usage behaviour (UB).

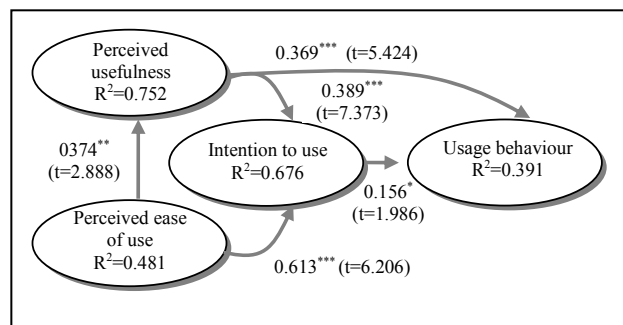
Independent of the internal constructs of the TAM model, FOSS users consider that the acceptance for FOSS is influenced by some external variables. Therefore, our goal is to identify the external constructs that influence the

intention of use a FOSS solution. With this objective in mind, we have taken as a reference the study elaborated previously by the authors Gallego et al. (2008). Based on this work, we consider suitable to include four external constructs to the TAM model. These variables are: system capability (SC), software flexibility (SF), software quality (SQ) and social influence (SI).

In a same way, based on the TAM model proposed by Gallego et al. (2008) about FOSS usage behaviour, we formulate an acceptance model that was validated in the cited work with a sample with 347 Linux users. This model explains the user behaviour for FOSS solutions in a 39.1% (Fig. 1). We asked to the users of the sample the years of experience with FOSS for completing our study.

Fig. 1. Reduced research model.

Source: by Gallego et al. (2008)



The experience with FOSS already had been including in other similar studies. The experience with FOSS allows to users the assimilation of information about this software solution and to increase the knowledge on its advantages. In this sense, the user experience influences the user perceptions for FOSS. Some researchers, such as Igbaria and Chakrabarti (1990), Igbaria and Nachman (1990) or Agarwal and Prasad (1999), suggest that the user experience with a technology improves the perceptions and attitudes towards the use. Based on this point of view, we formulate the first working hypotheses of this research. These hypotheses are stated in the following way:

- Hypothesis 1 (H1): The user experience with FOSS has a positive effect on perceived ease of use for FOSS
- Hypothesis 2 (H2): The user experience with FOSS has a positive effect on perceived usefulness for FOSS.
- Hypothesis 3 (H3): The user experience with FOSS has a positive effect on intention to use for FOSS
- Hypothesis 4 (H4): The user experience with FOSS will have a positive effect on usage behaviour for FOSS

3. SAMPLE INFORMATION AND PRELIMINARY ANALYSIS

We have selected Linux FOSS users for the sample of our study. We understand that these users are a representation of all FOSS users, and the results obtained could extrapolate any solution based on FOSS. In this sense, we turned to The Linux Counter website, where we were able to access the contact information of the users that were registered in the website. The information provided to us happened to be organized by geographic areas. We selected the European countries which tended to have a higher number of registered users. Within each area, the selection made was completely at random. A total of 1,736 study invitations were sent out by electronic mail to registered Linux users in eleven different European countries. In the end, we received 363

survey responses. Of those, 347 were complete and valid for our study. This number represents a response rate of twenty percent.

In order to measure each one the variables included in the TAM model developed for our study, we carried out a review of the literature that allowed identifying items for each one of the constructs. The survey and the selection of the sample used for the study already were validated Gallego et al. (2008).

In order to cover the main objective of this study, the users of the sample indicated the years of experience with FOSS. The feedback obtained allows realizing a descriptive analysis about the user experience with FOSS and classifying the sample in three categories of users (see Table I). Besides, we have could can observe that the average years of experience with FOSS is very high, (7.43 years). This data shows the loyalty of FOSS users towards this type of technology.

Table 1: descriptive analysis

Mean	S.D.	Categories	Number of participants
		Less than 5 years	106
7,43	3,33	Between 6 - 9 years	131
		More than 10 years	110

4. ANALYSIS AND FINDINGS

In order to agree upon all the hypotheses collected in the research model, a causal analysis have been developed. The research models were tested by structural equation modelling (SEM) using Lisrel 8.51 with maximum-likelihood estimation. The parameters that represent the regression coefficients among the constructs are indicated with the symbol γ if the relationship it represents is between an independent construct and a dependent one. If the relationship established is between two dependent constructs, it is indicated with the symbol β .

$$PEU = \gamma_1 SC + \gamma_2 SI + SF \gamma_3 + \varepsilon_1$$

$$PU = \gamma_4 SQ + SC \gamma_5 + SI \gamma_6 + \beta_1 PEU + \varepsilon_2$$

$$IU = \beta_2 PEU + \beta_3 PU + \varepsilon_3$$

$$UB = \beta_4 IU + \beta_5 PU + \varepsilon_4$$

For the Lisrel, we were able to prove how the model very adequately explains the variance in the perceived ease of use ($R^2=0,481$), perceived usefulness ($R^2=0,752$), intention to use ($R^2=0,676$) and usage behaviour ($R^2=0,391$) Gallego et al. (2008). Based on these findings, we have developed a causal analysis to each group of user experience with FOSS. After, we will compare the findings. The comparison analysis will allow obtaining significant discussions about the influence of user experience the FOSS acceptance. We also use Lisrel 8.51 with maximum-likelihood estimation.

5. RESEARCH MODEL TEST

The user experience toward a certain type of technology has generally a positive effect on the perceptions and attitudes towards the use. In our particular research, we want to test the positive influence of the user experience with FOSS on perceived ease of use (H1), perceived usefulness (H2), intention to use (H3) and usage behaviour (H4) for FOSS. Finally, in order to test satisfactorily all the hypotheses, we have divided the sample in two sub-samples (see Table II). This decision is adopted to obtain sufficiently wide sub-samples for reaching estimations of the regression equations with the software Lisrel (Boomsma, 1982).

The hypotheses were tested for $p < 0.05^*$, $p < 0.01^{**}$, $p < 0.001^{***}$ (based on $t(499)$; $t(0.05;499) = 1.967007242$; $t(0.01; 499) = 2.590452926$; $t(0.001;499) = 3.319543035$).

Table 2: Model hypotheses contrast

Interval of year	Relationship	γ or β	t-student	R2	R2	Interval of year	Relationship	γ or β	t-student	R2	R2		
Up to seven years of user's experience with FOSS	SC → PEU	0.394	4.435	0.446	0.481	More than seven years of user's experience with FOSS	SC → PEU	0.565	4.041	0.676	0.481		
	SI → PEU	0.0298	0.539				SI → PEU	0.0274	0.604				
	SF → PEU	0.118	2.034				SF → PEU	0.114	3.697				
	PEU → PU	0.440	3.164				PEU → PU	0.384	1.124				
	SQ → PU	0.775	4.756	0.820	0.752		SQ → PU	0.714	3.283	0.777	0.752		
	SC → PU	0.0904	0.593	SI → PU	0.00596		0.0852	SC → PU	0.788	1.571	SI → PU	0.0500	0.544
	PEU → UB	0.677	4.883	0.675	0.676		PEU → UB	0.737	4.198	0.685	0.676		
	PU → UB	0.412	4.772	PU → UB	0.350		5.396						
PU → IU	0.355	3.458	0.463	0.391	PU → IU	0.316	3.960	0.319	0.391				
UB → IU	0.279	2.613	AU → IU	0.0176	0.160								

These findings show the high significance of the relationship posed in hypothesis H1, between perceived ease of use and user experience. Specifically, the sub-group formed by users with experience with more than seven years has an explained variance of 0.676. The group of users with less than seven years of FOSS experience has an explained variance of 0.446. In both case the level of significance is very high. According to these findings, hypothesis H1 is tested significantly.

Regarding to the perception of usefulness, we can observe how the users with less experience perceive more usefulness (0.820) than the users with major experience (0.777). These results don't verify the positive relationship defined in the hypothesis H2. For that, we can't accept the hypothesis H2.

Finally, with respect to the hypotheses H3 and H4, which define the positive effect between the FOSS experience with the usage behaviour and the intention to use an FOSS solution, we can't accept them. In these sense, the hypotheses H3 and H4 have not been tested significantly.

Nevertheless, based on these findings, we can't state that the user experience with FOSS has a negative effect on perception of usefulness, usage behaviour or intention to use a FOSS solution. Only we can confirm that these relationships aren't positive or don't exist a significant difference.

6. DISCUSSIONS

Even though research on FOSS has proliferated in recent years, the acceptance of this type of technological solution on behalf of the users had not been tackled. Thus, the main objective that we pose with this research is to analyze the influence of the user experience with FOSS the acceptance towards this type of technology. With this aim, we have formulated a Technology Acceptance Model based on a previous study of the authors. Besides, we have identified relevant discussions about the influence of user experience the FOSS acceptance.

First, we have observed the particularity of FOSS. Specifically, the positive relationship between user experience and perceived ease of use for FOSS (H1) has been tested significantly. Nevertheless, there aren't significant

differences about the perception of usefulness, intention to use or user behaviour between users with different level of experience (hypotheses H2, H3 and H4).

Second, with these findings we cannot affirm that exist negative relationships with respect the perception of usefulness, intention to use or user behaviour with the level of experience. For that, these findings show the particularity of the FOSS movement.

Thirds, based on the findings, we can affirm that the FOSS governmental organizations and developers must favourer the flow of FOSS information for fomenting the use of these solutions. With this in mind, we think that the efforts of organizations for increasing the number of FOSS users must be orientated to users who only apply proprietary solutions.

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