Interactions with Open Source Software: a pilot study on end users' perception

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Abstract Interest of scientific research on Open Source software and its development process is frequent. The number of articles available and the number of tracks or workshops on this topic in most relevant IS Conferences is high. The usability of Open Source Software has been scarcely considered until few years ago, probably due to the particular role that the user has in such a development environment. In Open Source software development users and developers are not so different. Anyhow, the diffusion of the Open Source software outside the development community contributes to sharpen the distinction among these two groups that are no longer equivalent. This circumstance has contributed to increase the interest on usability of Open Source software. Nevertheless, studies on end users in Open Source contexts are still young. This paper introduces a pilot study on the perception of the end user on Open Source software. The aim of this pilot study is to identify how the end user perceives the Open Source software (in terms of Usability, Functionality, Reliability, Efficiency and Quality in Use).

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Introduction

The interest of scientific research on Open Source software and its development process is directly witnessed by the body of articles available [1] and by the number of tracks or workshops devoted to this topic in most relevant IS Conferences (ie: ECIS 2007, ECIS 2008, Open Source Systems 2008 and IFIP WCC 2008).

Researchers acknowledge that Open Source software has a high impact potential on economic and social infrastructure [2]. On the base of the assumption that Open Source Software development processes contribute to a better output in comparison to traditional development methodologies [3, 4, 5], several studies started to investigate the adoption of Open Source based solutions in different environments [6, 7]. Large part of available studies focus on the internal perspective on the Open Source software usage, without taking the end user into consideration.

This paper introduces a pilot study on the perception of the end user on Open Source software. The aim of this study is to identify how the end user perceives the Open Source software (in terms of Usability, Functionality, Reliability, Efficiency and Quality in Use). This article is structured as follows: after the research design, a brief literature review will describe the theoretical framework and the results of the pilot study will be introduced. A discussion of findings and a conclusion will follow.

Research Design

Studies on Open Source Software have to deal with the difficulties in the selection of a random sample of users [8]. Usually the source code of Open Source software is freely distributed over the internet: this makes the real population of users unknown and impedes the possibility to create a truly random sample of users. In this pilot study we therefore decided to adopt an interpretive approach in order to try to understand how end users perceive the Open Source software. Our aim is

not to predict or establish general law (as in a positivist study), but to comprehend the phenomenon from the point of view of the people involved in it, and to gain thorough understandings of it.

The software adopted in this pilot study is Moodle, one of the most commonly used Open Source e-learning platforms. This software was used by a group of 80 students attending the "Computer mediated Training" course in a faculty of Education Science. These students used the platform for 6 months, both to download/upload contents and to create contents in training courses.

We created a survey using the focus group technique (involving about the 10% of the final sample size) to define the most relevant aspects perceived by the users. The users' derived dimensions were confronted by those indicated in the ISO 9126 and ISO 25000 software quality model that we used as a reference. We decided to adopt these models to deepen the understanding of our case, mainly because they include not only the Usability as a dimension, but others, interrelated, areas. We excluded from the dimension covered by the survey those that cannot be evaluated under the end user's perspective (ie: Maintainability and Portability). As a result the survey covers the following areas of the aforementioned standards: Functionality, Reliability, Usability, Efficiency and Quality in Use. In the survey we added another variable called General Satisfaction as a control variable to explain the other dimensions. Before submitting to the end users, the survey was tested with another sample of users to ensure that the text was clear enough.

Theoretical framework

The usability in the Open Source Software development has been scarcely considered until few years ago, probably due to the particular role that the user has in such a development environment. Open Source Software development has usually been based on the blurred distinction between users and developers. In traditional Open Source Software development process, the developer is a user at the same time, but it can easily turn into a developer, contributing to the project by submit-

ting a patch, writing a piece of code or doing other activities. It can therefore be argued that the Open Source Software development process relies on the assumption that users and developers may converge. The diffusion of Open Source Software outside the development community contributes to sharpen the distinction between these two groups that are no longer equivalent. As a matter of fact they are nowadays too different [9]. In the traditional organization of an Open Source Software development process, users outside the community are hardly ever taken into consideration during the development. This call for major involvement of HCI expert inside Open Source Development projects, as the interface design might not be treated with the same openness that is used for the source code [9].

This set of circumstances has contributed to increase the interest of the research on Open Source adopting an end user perspective. As a consequence, the number of work on FLOSS usability is increasing (see for example [10, 11, 12, 13]). Recently large attention has been paid to flexibility, efficiency, robustness and effectiveness [10, 14]. Large part of available contributions try to provide suggestions to reduce the gap between the developers and the users outside the development community, trying to suggest methods to consider their needs in the development project. Studies on users' perception on Open Source Software are anyhow quite young.

Traditionally Open Source has been considered as a development process that could have a great chance to produce a successful piece of software due to the so called "Linus Law" [15] that synthesize the effect of the peer review process: "given enough eyeballs all bugs are shallow". This anecdotal assumption has been described by a predictive mathematical model [16] which states that OSS can converge to a bug free state even if average programmers quality is lower than the one employed in a traditional environment. Code inspection and statistical analysis of defect density have commonly been used to assess the goodness of Open Source projects [17, 18].

As a matter of fact, in a frequently cited IS success model [19, 20], DeLone and McLean contribute to highlight that between the software (system) quality and the benefits connected to its use, there is the user satisfaction. In an adapted version of

DeLone and McLean IS success model (specific for Open Source) [21], Sang-Yong et al. identify that the user satisfaction is affected by software quality. Anyhow, recalling the possible differences among developers and users in the Open Source context, it is not granted that the software quality level is exactly the one that the user needs and, at the same time, it is not even granted that this is the only relevant dimension for him. The internal characteristics of the Open Source Software might therefore be high and respect high standard but they might even be not what the user wants or desire or, under a different point of view, the users might not be in the position to perceive and evaluate them.

Results of the pilot study

In total we received 59 filled surveys. Data obtained from the survey have been analyzed using descriptive statistics. We calculated the Cronbach's alpha as a reliability index for the results of the survey. The value for our survey is 0.84, which is high enough for an explorative study [22].

The user's profile emerging from the survey is as follows. Almost two third of the respondents (69%) have an age between 23 and 32 years, they use the computer for more than 7-9 years (61%), and have been using the Moodle platform at least 1-2 times a week (for 57% of the respondents). In general, the respondents do not have great experience with other Open Source Software because, on average, more than half of the respondents have never used other Open Source software.

The respondents profile has been analyzed using some descriptive statistics. The results are shown in Table 1: the scores of these variables have been obtained by calculating the average score of each group of questions (in the survey) that were specifically referred to the variables indicated in Table 1. These results show a good level of satisfaction of the respondents with Moodle, that is at the same time confirmed by the low level of the variance and of the standard deviation. Anyhow it has to be taken into consideration that the short Likert scale (from 1 to 4) tend to foster low variation.

Table 1. Descriptive statistic (1 min – 4 max)

Area	Obs	Mean	Std Dev	Var	Min	Max
Functionality	59	3.12	0.59	0.35	2	4
Reliability	59	2.92	0.82	0.66	1	4
Usability	59	3.33	0.71	0.50	1	4
Efficiency	59	3.25	0.68	0.46	2	4
Quality in Use	59	3.29	0.58	0.33	2	4
General satisfaction	59	3.41	0.53	0.28	2	4

Further information can be obtained dividing the respondents into two groups, according to the depth of usage of the e-learning platform. We therefore distinguish between basic and advanced users. Respondents were asked to state which features they had used in the Moodle platform. These features were divided in two groups (basic and advanced) and these distinction was used to establish the depth of usage.
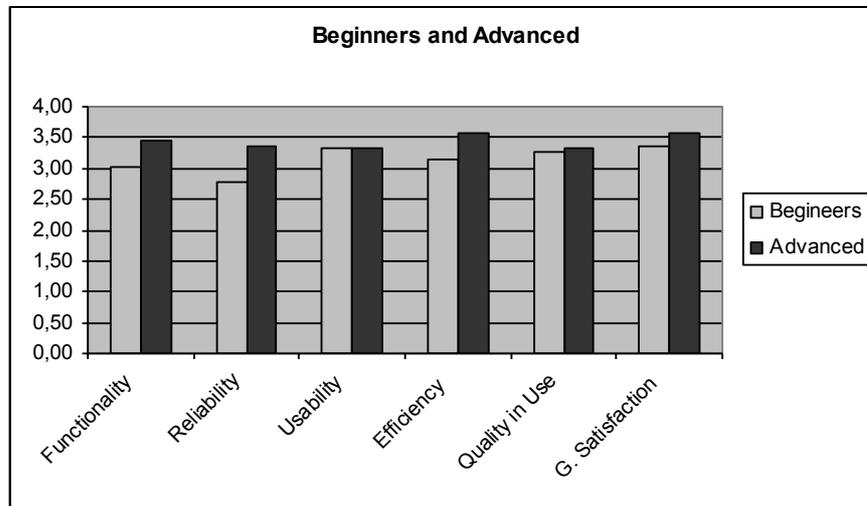
Fig. 1. Beginners and Advanced compared scores

The results are depicted in Fig. 1 and they show that beginners (45 users) have lower scores than advanced (14 users), especially in three areas: Functionality, Reliability and Efficiency. In general, beginners are less satisfied than advanced users. Similar considerations can be formulated referring to the experience of each user with Open Source software in general. The few respondents (4 users) that indicated to be familiar with other Open Source software, they have, on average, higher scores on all the dimensions.

Table 2. Correlation matrix

	Functionality	Reliability	Usability	Efficiency	Quality in Use
General satisfaction	0.61	0.39	0.56	0.38	0.56

Table 2 illustrate a correlation matrix among the five areas covered by the survey (Functionality, Reliability, Usability, Efficiency and Quality in Use) and the control variable called General satisfaction. The matrix shows positive correlation among the dimensions and significant values for the Functionality, the Usability and the Quality in Use areas.

Finally Table 3 contains the linear regression model where the general satisfaction has been taken as an independent variable and has to be explained by the other six variables. The results of the regression model allow us to affirm that there is a predictive linkage only for three variables: Functionality, Usability and Quality in Use. Out of these three variables, the Functionality is the one for which the linkage is the strongest. Reliability and Efficiency show a negative value.

The significance of the proposed linear regression model is partially validated by the F test study which is higher than 1 (13,50) and allow us to refuse the H_0: $\beta=0$ hypothesis (the absence of a linear regression linkage among variables taken into consideration) and implicitly accept the H_1: $\beta \neq 0$ hypothesis (the existence of a linear regression linkage among variables). Furthermore, the Adj R-squared index shows that only 52% of the total variance can be explained by the linear regression model.

Table 3. Linear Regression

	Coeff.	t	P>|t|
Constant	0,820	2,46	0,017
Functionality	0,369	4,23	0,000
Reliability	- 0,120	-0,17	0,866
Usability	0,182	2,01	0,049
Efficiency	- 0,001	-0,01	0,989
Quality in use	0,248	2,21	0,031
Obs: 59	Adj R-Squared = 0,52	F Test = 13,50	

Finally, the p-value indicator (that gives us information on the validity of the null hypothesis) shows low probabilities for the Functionality (less than 1%), the Usability (around 5%) and the Quality in Use (around 3%). The p-value for Reliability can confirm the existence of a negative value while for the Efficiency we can hypothesize the total absence of relationships.

Discussion

The results of the survey shows that the measured end user's perception on the dimension adopted was quite high and in general, the user is satisfied of his experience with the software. Looking at the descriptive statistics on the six variables considered in this survey we can affirm that not all of them perform in the same way. In general, our sample of users, indicated the Reliability as the less satisfactory area. This area has, in fact, the lowest score and the highest variation. According to us, it is worthwhile to pay attention to the fact that Reliability (as defined in the ISO 9126 and ISO 25000 standards) is, among all the software characteristics, the one that considers software defects. This score let therefore us think that code quality and software correctness are not enough to achieve a successful user interaction with Open Source software. It is worthwhile to mention that this result is

even confirmed by the test sample we used to validate the survey (which was formed by a smaller group of students who attended a different training course and who used the same Moodle platform).

The identification of the two users profile (advanced/beginners, and expert/non-expert) has contributed to identify that both the experience with the specific software and the experience with other Open Source software may contribute to increase users perception. Anyhow, it has to be considered that these users received specific training on the features of the Moodle e-learning platform.

Finally, the correlation matrix and the linear regression model highlight that Functionality, Usability and Quality in Use are the dimensions that mainly impact users experience with the software. From the linear regression model we can assert that the Efficiency is of no importance for end users and that there is an inverse relationship between Reliability and Quality in Use.

Conclusions

Open Source software and its development processes are nowadays objects of interest for IS research. Past research on this topic have contributed to analyze that the Open Source development process can contribute to produce better software. Anyhow these judgements have always been based on an internal evaluation of software characteristics, on the base of the assumption that a high quality software could satisfy the needs of the users. Under this point of view Open Source software development counted, for long time, on the similarity between users and developers. With its diffusion, Open Source software has now reached users outside the development community and these users might have different needs than those expressed by traditional ones. Under this point of view, it is worthwhile to investigate end users experiences with Open Source software.

In this research paper we introduced a pilot study on end user perception on Open Source software. We analyzed the general perception of a sample of students that used the Moodle e-learning platform for 6 months. We used a model

based on the following dimensions: Functionality, Reliability, Usability, Efficiency, Quality in Use and General Satisfaction. Our results show that, in our case, the scores were sufficiently high, even if users perceive the Reliability as the less satisfactory area and are not in the position to formulate adequate judgements on the Efficiency.

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