Open Source Software Innovation Process: Does Gender Still Matter?

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ABSTRACT
Using data from in-depth interviews and Delphi method on Open Source Software (OSS) contributors, this study uses a social constructivist and feminist perspective model to investigate the gender’s contribution in OSS innovation process. The results show that both male and female contributors have their preferences in term of roles and contributions in OSS. The type of contributions varies from technical or non-technical aspects of OSS process. This paper provides understanding of how the participation and contribution of gender in OSS will help in attracting and retaining them in OSS innovation process.

Keywords: Open Source Software, SCOT, Feminist Approach, Gender and Technology.

I INTRODUCTION
In recent years, many scholars and practitioners have showed their interests in Open Source Software (OSS) innovation process (Ke& Zhang, 2011). OSS innovation process is heterogeneous in nature where it involves a combination of many aspects namely social, technical, economic, political issues (Lin, 2004). OSS projects merely rely on contributions from the engagement of contributors regardless of skin colours and genders across the globe working together in every part of the process (Wang & Chen, 2005). Engagements of OSS contributors are based on knowledge and skills exchange; and eventually improved software technology (Nafus, 2011).

Although OSS innovation process has offered a fairer, more democratic model with its philosophy of ‘freedom’ (like freedom of speech', not 'price’) and ‘openness’ that has changed the way software is developed, gender problems in software industry is still the same (Lin, 2005a). The specific ways OSS instantiates openness philosophy in exacerbates the exclusion of women in its process (Nafus, 2011).

Previous studies showed a great gap between genders where less than 2% are female contributors in OSS development (Ghosh, Glott, Krieger, & Robles, 2002; Nafus, Leach, & Krieger, 2006). Surprisingly, there is still no evidence that women’s participation level has changed from the previous studies (Nafus, 2011).

This study is trying to find the answer for: to what extend does gender variation affect the process of Open Source Software Innovation?

The research question addresses the relationship between gender and the developmental context of OSS. The interest is on documenting the social processes through which OSS innovation came to acquire their characteristics. It is about how the interests and values of gender constitute or shape the characteristic of OSS.

The sub-questions that made up the main questions are: How gender’s plays a role in developing OSS innovation? What are the similar interpretations that influence the interactions among gender and lead to the attribution of meanings to OSS innovation? and, How does gender affect the closure and stabilization of OSS innovation?

In finding the answer, conceptual framework of Social-OSS innovation in OSS community to guide the study is described in following section. Section III explains the study approach in conducting the research. Section IV, present the findings and discussion of this study. The last section, presents the concluding remarks of the study.

II CONCEPTUAL FRAMEWORK OF SOCIAL-OSS INNOVATION IN OSS COMMUNITY
The conceptual framework of Social-OSS innovation in OSS community is based on the stand that OSS innovation is a product of socio-technical process (Mahmod, Yusof, & Dahalin, 2010a, 2010b). The proposed relationships among the constructs of interests in this conceptual framework are derived from Social Construction of Technology Theory (SCOT) theory by Pinch & Bijker (1984), Feminist theory (Cockburn & Ormrod, 1993) and Technology Use concept (Crowston et al., 2008). Since OSS process involves diverse social groups of contributors, SCOT theory is applied. Feminist theory is crucial since it pays particular attention to gender’ contributions that help shape and assign meanings to OSS (Mahmod, Yusof, & Dahalin, 2010a, 2010b). The concept of technology use are used in the study along with SCOT and feminist theory since the nature
of OSS development is mostly relies heavily on computer-mediated communication

III STUDY APPROACH

This study employed qualitative methodology to seek the empirical inquiry of real-life events on how OSS is being innovated in terms of plan, design and implementation in OSS communities. Qualitative methodology provides a rich understanding of the phenomenon thus answering the “how” and “why” research questions.

Started by analyzing the existing work and literature regarding technological and sociological perspectives on OSS process, the study continues by employing in-depth interviews with OSS contributors and Delphi method with the experts in OSS communities. It is crucial for this study to assemble diverse and balanced discussion group. In order to meet this requirement, two types of sampling have been chosen: 1) snowball sampling strategy to populating the panel of experts in the Delphi method and 2) purposive sampling. Purposive sampling technique suits this study since it enables us to select informants on the basis of certain criteria which satisfy the specific needs in a study (Robson, 1993). The selection of informants in this study will be selected for the main purpose of collecting as much rich information for a comprehensive depiction of OSS innovation thus, identifying informants with particular characteristics who can provide an in-depth portrayal of OSS innovation

A. In-depth Interview

In-depth interviews consist of questions regarding OSS innovation process and gender contributions guided by the conceptual framework were conducted with eleven OSS contributors including two female contributors were done during two OSS conferences between July, 2011 to December, 2011. The interviews are voice recorded and transcribed into English language.

Although it is hard to get the informants for physical interview setting as most of the OSS processes were done online, several conferences on OSS got them together physically thus drew the opportunity of interviewing them face-to-face. It is a more effective technique for information gathering because of the evident non-verbal cues that facilitate interpretation. From the in-depth interviews conducted, males are the majority with 9 interviewees while only 2 are females with most of them are in their 20s with varies education qualifications (Mahmod & Dahalin, 2012). The evidences collected during the interview are the basis for the construction of the Delphi questionnaire.

B. Delphi Method

Three rounds of Delphi method were conducted with 6 experts in OSS communities to get consensus or the final judgments. However, only one female expert is involved since it was challenging to find one because of the scarcity of female contributors in OSS process. Delphi method could be used to replace most of the face-to-face meetings and is suitable for nearly any problems related on decision-making, estimation and complex judgment that must include experts’ opinions and judgment (Green, Armstrong, & Graefe, 2007).

The first round (R1) of Delphi method is conducted using a set of questionnaire based on conceptual framework of Social-OSS innovation and the data gathered during the in-depth interview. The first round required the experts determine the relative rank or priority of the items identified under each of the sections which were rated using 5-point Likert-type scale of. The results were analyzed by using the median score, instead of mean. Median of the responses to each item was chosen as the measure of central tendency rather than mean. However, median as a single value alone are not able to give adequate information to interpret results because “it does not reveal the Statistical distribution of the experts’ answers” (Zipfinger, 2007:37). In order to get the idea of the range of variety of answers, thus, it is needed to calculate Inter-Quartile Range (IQR). R1, second round (R2) and third round (R3) utilized the quartile deviation (QD) to identify the consensus.

The second round (R2) of Delphi method considered the answers and suggestions from R1. The panels are informed of the overall responses by the other experts and are asked to examine their own responses with regard to the overall responses.

In the third round (R3) or the final round of Delphi method, experts were again asked to examine their responses with regard to overall experts’ responses that in the end become the final judgment or consensus as to their priority of extremely relevant.

As shown in Table 1, analysis is done based on classifications where the consensus was determined at three levels (Kasem, 1979; Norizan, 2003). High level consensus and moderate level of consensus of the results gathered are considered in this study.
Table 1. Level of Consensus and Importance

<table>
<thead>
<tr>
<th>Quartile Deviation</th>
<th>Level of Consensus</th>
<th>Median</th>
<th>Level of Importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less or equal to 0.5 (QD ≤ 0.5)</td>
<td>High</td>
<td>4 and above (M ≥ 4)</td>
<td>High</td>
</tr>
<tr>
<td>More than 0.5 and less than or equal to 1.0 (0.5 &lt; QD ≤ 1.0)</td>
<td>Moderate</td>
<td>3.5 and less (M ≤ 3.5)</td>
<td>Low</td>
</tr>
<tr>
<td>More than 1.0 (QD &gt; 1.0)</td>
<td>Low and no consensus</td>
<td>-----</td>
<td>-----</td>
</tr>
</tbody>
</table>

IV RESULTS AND DISCUSSION

A. “How gender plays a role in developing OSS innovation in OSS community?”

Both genders play their roles in OSS innovation process whether directly or indirectly as code developers, writing documentations, involved in designing and just by simply asking questions.

From the interview data, all of the male interviewees were the code developers for OSS project(s) while both of the female interviewees are contributing in less technical aspect of OSS project(s) such as localisation, bug reporter (who discover and report bugs, they do not fix the bugs themselves) and promoting OSS. Male tends to play their roles in more technical related role in OSS projects like code developer, fixing bugs and writing their own documentation on the patches they have written which required more time to spend on. The difference in roles in OSS projects between genders due to several factors such as preference and life style as discussed in (Mahmod & Dahalin, 2012).

Be it technical or non-technical roles played by the contributors, all contributions are vital to OSS projects. According to panelist 3 (P03),

As we are a free non-profit project which does not earn directly from closed patented code, we vitally need all help for quite everything in the project, from website, wiki documentation to code and answering question (Q & A). Indirect help has social engineering values, such as from legal, accounting and business management faculties they contribute to the eco-system of OSS projects.

There are several roles on how genders play their role in OSS process. From the Delphi results, the level of consensus are high as where median scored 4 (refer to Table 1) most of the panellists agree that Project Leader is the most important role in OSS project. According to panelist 3 (P03), “Project leader has to be grounded in the rules of OSS project, for example, as the trunk control”. His statement showed that how important a project leader in determining the movement of OSS project. Expert (P05) however stated that users are the most important role in OSS project as they are the ones who use and support OSS project. But he changed his answer and agree with majority in the second round (R2) of Delphi. Maintainer and core developer of the OSS project scored as the second important role. Usually core developer is the maintainer. Many OSS projects died because of the absence of maintainer to maintain and manage the project. Other technical roles played by male contributors are as the code developer. Core developer are the ones who determines the architecture which influences the long term savings such as less code, less maintenance and more agile framework.

The non-technical role played by most female in OSS are like end users or as suggested by panelist P03 as the “downloaders”. Most downloaders are unaware that they are contributing to OSS promotion and movements. According to panelist P05,

they give hit rate that raises the project’s visibility and word of mouth due to the nature of web based context of OSS projects.

Both male and female play their different roles in contributing to OSS in several ways whether technical or just simply asking questions about the OSS. However, the technical contributors have made bigger impacts on the success of OSS project rather than other type of non-technical contribution. Panelist P03 strongly stated that

I still say technical roles have higher importance level in OSS project because quality of code surpasses other considerations, though it is controversial subject as non-technical people have made big impact on many OSS success.

It is clear on the preference and their justification of roles and contributions of technical and non-technical in OSS by the genders.
B. What are gender’s understandings and assumptions in OSS innovation?

Social groups such as the varied roles of contributors including genders in OSS projects share similar interpretation that give meaning and understanding on how OSS are designed. It shows that OSS project goals follow the mission of OSS community. As one interviewee (I04) said, “largely people are motivated more by the project goals directly rather than social peer influence”. Contributors of OSS join a particular OSS project because they share the same interest in goals of the project that shape similar interpretation of the meaning of OSS innovation.

All of the expert panelists agreed that goals of the project drive the contributors towards an OSS project though OSS project will evolve as distinct forks or its own category for example KDE desktop (a fork from Linux Kernel) viz a GNU Operating System.

However, the direction of OSS project such as the next release dependent on who is actually controlling the release which usually the case in the maintainers. The discussions and heated arguments are handled through online discussion mainly mailing list, forum, IRC and social network and (Concurrent Version System) CVS/GIT. GIT is a distributed revision control and help manage source code that emphasis on speed The differing of arguments among the contributors are;

*Usually inflammable and thus we find many serious participants not willing to inflame further and kept to the sidelines. So we find the norm that flames are ignored and many issues may not be solved but a status quo hangs in the air* panelist P03

Face-to-face meeting is one of the medium used to handle arguments regarding the next release. One panelist said (P04), “we tried to resolve via face-to-face and its positive, but wasn’t useful because when offline, it revert back”. Although OSS project may be sponsored by certain organization, the direction of the project can be driven exclusively but the contributors still have the say by requesting the organization to either fork the project as in the new GIT branching policy or become another distro of the same code but under a different branding exercise. This shows that the goals and mission of OSS project remain the same as the beginning of the project and contributors regardless of genders maintain the similar understanding of OSS.

C. How different gender’s interactions are affected by the communication technology in OSS innovation?

Gender namely male and female has different impacts on the shaping of OSS. Some contributors mainly male do not see gender differences impacted OSS outcome. Most of the male interviewees when asked the questions of whether they are aware of opposite gender of contributors in OSS project, only realized that they have assumed and generalized all contributors are males.

Judging from their nickname and their way of communicating most panellist answered most contributors are males. Only two of the interviewees (I01 and I04) certain there were opposite gender contributing in the new features, and design of OSS project. The rest of them did not sure but make assumption there might be some female but the nickname and identity was not made explicit.

When asked the female interviewees, they definitely aware of the gender difference and different treatments they received from other male contributors.”. Even a male interviewee admitted that he owns a nickname showing a female’s nickname where he usually receives flirtatious attempts from other contributors unlike when he used more male like nickname.

All the experts agree that the number of female in OSS project is extremely low, and put their hope to see more female participations in OSS projects to balance up the social atmosphere and dynamism. However it is tough for female to join the ‘hacker’ nature of OSS that based on strong programming culture involving long hour of coding activities. This is very hard for women to committedly contribute with less spare time in comparison with men as they need to attend to housework chores (Lin, 2005).

Since the gap between male and female contributors participation is very large, the panelist and interviewees come to an agreement that they cannot really draw a conclusion how much genders namely female affected the OSS release. P07 simply stated “there are too few of them to impact the direction”. However, a panelist acknowledges that some female contributors are also highly skilled technically that some who influence the decisions made based on their role in OSS project.
V CONCLUSION

OSS innovation process that based on volunteerism and contributions of its participant employs new types of socio-technical practices. In this paper, we tried to answer 3 sub research questions in order to find out to what extend does gender variations affected OSS innovation. Currently the enormous imbalanced gap between male and female contributors in OSS process cannot explicitly show the effect on OSS. Most of male contributors do not realize the gender variations exist in OSS projects when their assumptions that it is male playground. The study adds to the literature on gender and technology that shows OSS is clearly dominated by male where the role played by the contributors is the determinant of the direction of OSS projects.

However, this paper also discussed the possible types of contributions that might attract more female engagement in OSS projects. We hoped that this study will offer insights on how women play a role in contributing OSS projects through the lens of SCOT Theory with feminist foci.

REFERENCES


