

Contribution of Gender towards Open Source Software: A Preliminary Study

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ABSTRACT

Open Source Software (OSS) innovation process has become a prominent phenomenon on how software is developed. Yet, gender issues in software industry seem to be duplicated in OSS innovation process. This paper discusses preliminary findings to address the lacuna in the area of OSS innovation process and gender. The study is guided by Social Construction of Technology (SCOT) theory and Feminist theory. This study offer insights for OSS community, not only the benefit towards gender and minorities but familiarizing them with the dynamics, issues and challenges related to OSS innovation thus enhanced their understanding of gender's and minorities' contribution in OSS innovation.

Keywords: Open Source Software, SCOT, Feminist Theory

I OSS INNOVATION PROCESS

OSS innovation process shows a broad and relatively boundless innovation system which allow various types of actors (core developers, casual contributors, bug reporters, patch submitters and end-users) participating and engaging in its development (Lin, 2004). The phases of OSS innovation process cannot be clearly distinguished as the phases in proprietary software development. OSS is developed following Open Source (OS) methodology that consists of a set of principles and practices based on the contributions of shared knowledge from worldwide distributed contributors via the internet (Gacek & Arief, 2004; Stallman, 2007). The concept of OS is very simple; when all computers programmers are allowed to work freely on the source code of a program, the increasing transparency of the project allows collaborative engagement to correct errors and enables adaptation to different hardware platform and needs. Collaborative engagement of the developers has in fact build up OSS movement that is well known today for its high degree of reliability and portability (Wang & Chen, 2005).

OSS innovation process is an active socio-technical process which is not only influenced by social and technical issues but by various aspects including gender, economic and political issues (Lin, 2004). OSS development should be perceived as a social process through communication of computer technology and the social production of knowledge and values where in doing so contextualize and crystallize the socio-technical dynamics in software innovation (Lin, 2004).

To ensure a thorough picture of software innovation in OSS community is explored, multiple contexts of studies must be employed since a single technical perspective is not sufficient in understanding the nature of collaborative practices and interests of software innovation in OSS community (Lin, 2004). This is to suggest that both the social context namely the gender perspectives of the software innovation practices and technological issues in OSS communities should both be investigated since technology is gendered in design (Wajcman, 2004).

II PROBLEM STATEMENT

OSS popular philosophy of "freedom" (like freedom of 'speech', not 'price') (Raymond, 2001) and equality is not reflected well by a great gap of imbalance proportion of gender in its process (Lin, 2006). Thoughless hurdles for contributors to join OSS innovation process such as; no formal requirement on qualification or degree in Computer Science (CS) and related qualifications needed as compared to proprietary software industry, male contributors are still outnumbered female contributors with a great gap of more than 98% (Ghosh, Glott, Krieger, & Robles, 2002; Nafus, Leach, & Krieger, 2006). A study in Australia showed almost similar trend of only 7.3% are female contributors (Waugh Partners, 2008). This phenomenon has shown that, women are still under represented in OSS development thus demonstrates a phenomenon of social dynamic that is thoroughly

male dominated world where women do not play a role in OSS innovation (Lin, 2005a; Nafus *et al.*, 2006).

The gender problems in OSS innovation seem to be a continuation from the existing issues on women in software and technology industries (Lin, 2005). Discriminations, under-representation, and prejudices, sexism and 'glass ceilings' are among the long term existing problems regarding women and software industry where in order to obtain the same respect as men, women have to work harder than the opposite sex (Lin, 2005).

Since OSS innovation is very much depending on voluntary work that contributors carry out in their free time rather than as part of paid salary, a lot of measures that have been successfully applied in work environment of companies, public sectors institution are not applicable in OSS community context (Nafus, Leach, & Krieger, 2006). The activities tackling the gender issues should come from the inside of OSS community as a whole to decide upon how it should organize itself and communicate the social dynamic issues including the gender issues. The gender issues particularly like discrimination, inflammatory talk, inequality valuation of particular lack of participation from women have been voiced out by industrial people in many OSS technical conferences keynote, OSS communities and business journal (e.g Byron, 2007, 2009; Robert, 2009, Deckelmann, 2009; Malmrose, 2009; McPherson, 2009) but perplexingly received almost no attention from the academic literature (Lin, 2005a). This phenomenon shows there is a gap between the academic curiosity and industrial perceptions.

Most of the gender and technology literature have tended to concentrate on gender and technology in the workforce but there are only limited studies with regard to exploring how technological designs especially IT might differ depending on the gender of the designer and users (Rosser, 2005; Wajcman, 2010). It is not about the gap of men and women using computers, Information and Communication Technology (ICT) and other Information Systems (IS) since it is narrowing, but rather than women as part of the development team (Powell, Hunsinger, & Medlin, 2010). Many studies has revealed the analysis of how women have been excluded from technological fields like computer science and how gendered perceptions and values influence the technological design as well as the usage of the technology and come to a general understanding that

the exclusion of women is the result of strong relationship between men's performance of masculinities (Moore *et al.*, 2008; Wajcman 2009, 2004; Faulkner 2001; Cockburn and Ormrod 1993). Computer Science (CS) has been portrayed as "masculine" and thus seems to neglect women participation in this field (Hodgkinson L., 2000; Ilavarasan, 2006; Klawe, Whitney, & Simard, 2009).

The fact that women have practically no voice in the development of major technological innovations that affects our lives is a detriment of the technological industry and society as a whole (Wajcman, 2000). Exclusion of women in the technological production and creation will increasingly translate to social exclusion thus the under-representation of women in the science and technology area profoundly affects how the world is made (Wajcman, 2004). It is undeniable that every aspect of our lives is touch by socio-technical systems such as communication technology, transportation and even cooking, and unless women are in the engine rooms of technological production, the levers of powers cannot be touched by women (Wajcman, 2004)

A. Research Question

The main question this study needs to answer is: *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 to be addressed in this research have been defined through the lens of Social Constructions of Technology (SCOT) key arguments and Feminist approach's constructs. Sub-questions that will be answered 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?

For the preliminary study purposes, the first and second sub-research question will be discussed from semi-structured interview.

III RELEVANT THEORIES

This study applied the Social Construction of Technology Theory (SCOT) by Pinch & Bijker (1984), Feminist Theory (Cockburn & Omrod, 1993) and the concept of technology use by Crowston, Wei, Howison & Wiggins (2008). SCOT theory are applied on OSS innovation process that involves diverse social groups, while feminist theory pays particular attention to female contributions that help shape and assign meanings to the software. Since the nature of OSS development is mostly relies heavily on computer-mediated communication (Crowston, Annabi, Howison, & Masango, 2005; Crowston, Wei, Howison, & Wiggins, 2009), the concept of *technology use* are used in the study along with SCOT and feminist theory. The following discussions explain the reasons e of the theories and expectations to learn from applying them to OSS innovation.

A. Social Construction of Technology (SCOT)

Social interactions between contributors in OSS community are the keys of investigating the OSS innovation phenomenon. For that reason SCOT theory has been acknowledged as significant in several IS literature in studying the development and implementation of information systems (Mousavadin & Silva, 2009).

SCOT applies multidirectional views on the development of a technology contradicting to the linear models that follows a pre-specified step-by-step phases explicitly in many innovation studies, and implicitly in many of the history of technology studies. SCOT believes that technologies are socially formed but they are also shaped by other technologies and are not just purely social and technology's form is path dependent – that is, decisions made in the past constrain its evolution in the future. In other words, existing technologies will shape future technologies and decisions made in the past will shape future technological evolution. SCOT consists of four main concepts in its approach: 1) relevant social groups (RSGs); 2) interpretive flexibility; 3) technological frame, and 4) closure and/or stabilization (Bijker, 1995).

RSGs can be institutions and/or organization of groups of individuals that have the same set of meanings on a certain technological artifact in order to be considered 'relevant.' The. SCOT

approach views that a technological artifact has no value other than what RSGs see in it.

A Technological frame is the concept on sharing similar interpretations of an artifact within RSGs. This concept suggests that each member of the RSGs has similar interpretations and assigned same meaning towards an artifact. Technological frame or frame with respect to technology, facilitates or constrains the interaction in a RSG by providing its members with appropriate resources, tools and structures that lead to meanings attribution and constitution of an artifact.

Interpretive flexibility in SCOT means not just how people interpret or assign meanings to an artifact flexibly, but flexibility exists in how the artifacts are designed. It shows that there are also other possible ways in designing an artifact rather than just one possible way or one best way (Pinch & Bijker, 1984).

The concept of closure and stabilization happens when interpretive flexibility decreases that shows the meanings given to an artifact is becoming more stable and clearer. Closure is believed to have happened when one interpretation of the artifact emerges as dominant over others as a result of consensus from the process of social negotiation between RSGs. Finally, the artifact become ground and stabilizes around the dominant interpretation.

SCOT shows better articulation and methodologically robust than other neighboring theory such as Social Shaping of Technology (SST) and Actor-Network Theory (ANT) since it breaks down the technology development and change processes. It helps in giving guidelines that are heuristically constructive in analyzing and describing the development of a technology (Pinch & Bijker, 1984).

However, most of constructivist studies of technology and innovation including SCOT ignore gender in their models. In general, SCOT has particular problem in methodology is problematic when addressing the gender divisions since its analyses starts with only actors who are directly involved with that technology. It failed to see women's involvement in development and consumptions of many technologies (Winner, 1993) thus led to the representation of technology is sharply gendered (Wajcman, 2000). Feminist Theory is applied along with SCOT in this study.

B. Feminist Theory

Most of feminist scholars in the field of technology studies view technology as socially constructed and gender plays a role in its production (Faulkner, 2000) as both men and women have gender identities which structure their experience and beliefs (Faulkner, 2000; Wajcman, 2000). Two important foundations on feminist technology concept (Cockburn & Omrod, 1993; Wajcman, 2004) is *gender relations/structures*; and *gender identities/symbols*. Gender relations shows that the particular power dynamics which is embodied in the conceptualization of differences and sameness, or inequalities or assumed equalities between men and women (Gillard, Howcroft, Mitev, & Richardson, 2008). It recognizes that men and women are structurally positioned differently in society, hence considers how this differentiation acts as the basis for the unequal distribution of power although not all men and women share the same experiences (Gillard et al., 2008).

Gender identities/symbols is about how we go as regards for being men and women. It captures the perception of socio-technical in technology development that social and technological elements are mutually constituting and so does gender and technology (Faulkner, 2000). Therefore, the feminist approach to technology studies suggests that a technology development and use cannot be understood without reference to gender and vice versa.

B. Conceptual Framework

Taking the stand that OSS innovation is a product of socio-technical process, this study applies SCOT theory by Pinch & Bijker (1984), Feminist theory (Cockburn & Ormrod, 1993) and Technology Use concept (Crowston et al., 2008). SCOT theory are applied on OSS community's process of software development and innovation that involves diverse social groups while feminist theory pays particular attention to gender's contributions that help shape and assign meanings to OSS (Mahmod, Yusof, & Dahalin, 2010a, 2010b).

As shown on Table 1, nine of the interviewees are males while only two are females as majority of the contributors who participate in both OSS conferences between the dates are males. Majority of the interviewees are between the age of 20 to 30 years old whom four out of six are still students finishing their degree. Only 2 interviewees who are

both males are in between the age of 41 to 50 years old. Both of them are well-known OSS contributors in Malaysia who owns IT based company.

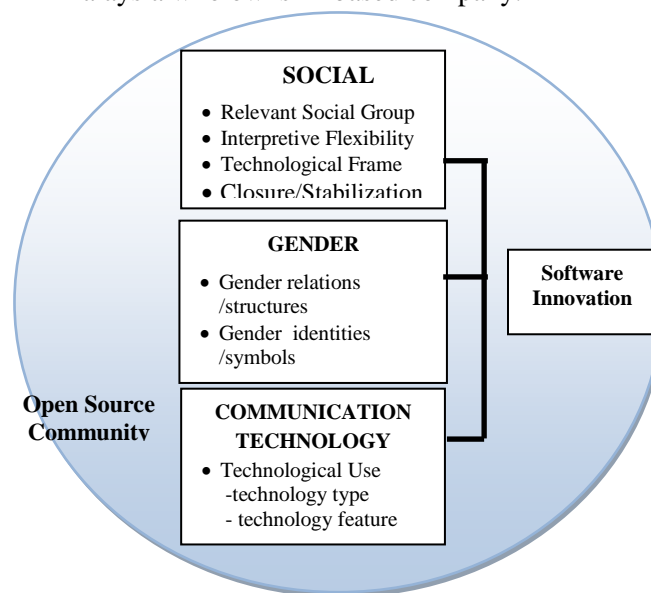


Figure 1: Conceptual Framework of Social-OSS innovation in OSS community

Demographic Details	f	Demographic Details	f
<u>Gender:</u>		<u>Level of Education</u>	
Male	9	SPM @ O-level	1
Female	2	Diploma	4
		Degree	6
<u>Age</u>		<u>OSS experience</u>	
20 – 30 years old	6	1-5	8
31 – 40 years old	3	5-10	3
41 – 50 years old	2		

Table 1: Demographic Details

When asked about education levels, majority of the contributors have a degree but not specifically in CS or IT related field, while four have diploma in IT and CS related field. There is one interviewee whose role in OSS project is quite prominent possessed only SPM certificate. This reflected that OSS does not require formal qualifications as the entry requirement.

IV CONTRIBUTION OF GENDER IN OSS

The semi-structured interviews are used to answer the first sub-question: *How gender plays a role in developing OSS innovation in OSS community?* Thus achieving the first sub-objective that is: to identify the gender's role in OSS community.

Both male and female contribute in OSS projects and community. All the male interviewees are code developers for several projects where they regularly contribute new features and fix bugs and as one of the major development forces of OSS. They also admit that most of the times they write their own documentations. In a probing question, when asked are they aware of opposite gender's contribution, one of them answered that he has been assuming and generalizing that all are male developers judging from their nick and their way of communicating. Only two of them are 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 nick and identity was not made explicit. The following statement is from one male interviewee: "Well from the Nick I cannot be sure about their gender. For example the nick Christian, it can be a guy or a girl. But I think it must be a guy because mostly they are (developers) guys". A male interviewee admitted that he owns a nick that reflected a female's nick where he usually receives flirtatious attempts from other contributors.

The reasons of contributing answered by male interviewees are passion, having funs, build up reputation, making money, widening the network or circle of people who shared the same passion and job related. Nevertheless, all of them admitted that they are aware that females asked a lot of question regarding installation and usage of a particular OSS instead of contributing in terms of codes, documentation and localisation. This scenario made them concluded that females do not have the passion or simply lazy to explore the OSS although the manuals are prepared but they rather chose to get faster response by asking questions.

When asked their opinions on the reason of lack of female contributors, three of the interviewees exclaimed excitedly that "we would love to have more females here that will surely boost our productivity". But their opinion, female's interest for OSS is not as much as theirs.

Both of the female interviewees are contributing in localisation and promoting OSS. Both of them do not write codes or doing anything technical. In a probing question that followed, both female interviewees were asked on why not contributing in technical aspect like doing code and fixing bugs. Both stated that they did not have much time to spend as they have paid work to prioritized but they

tried to contribute in other way like localisation, bug reporter (who discover and report bugs, they do not fix the bugs themselves) and promoting OSS to others such as participating in OSS programs in several local universities. They added that showing up to OSS community meet ups, conferences are another way of contributing to OSS. The reason the contributing to OSS is because they were involved with OSS during their study years and introduced at work place. One of the interviewee reason is because of her spouse is an active OSS contributors that somehow drawn her to OSS too. Although female contributors have the passion for OSS but the constraints on time juggling work and life are always there that somehow hinders their participation.

Both male and female play their roles in contributing to OSS in several ways whether technical or just simply asking questions about the OSS. It is clear on the preference of role and contributions in OSS by the gender and their justification.

V CONCLUSIONS AND FUTURE WORK

In this paper, we have tried to identify the gender identity, the role and contributions by gender in OSS innovation process. SCOT theory and Feminist Theory are applied to accomplish this.

The most immediate task now is to conduct three-round of Delphi method with identified experts in OSS to further answer the rest of the sub-questions thus triangulate the existing information gathered.

Despite the shortcomings of answering only the first sub-question, we chose to publish preliminary results of our efforts in the spirit of OSS "release early and often".

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