

Where are the Female Developers? Exploring the Gender Issues in Open Source Software Innovation Process

Musyrifah Mahmud¹, Shafiz Affendi Mohd Yusof², Zulkhairi Md. Dahalin³

^{1,3}Applied Sciences Divison,
College of Arts and Sciences,
Universiti Utara Malaysia (UUM),
06010 UUM Sintok,
Kedah, MALAYSIA

¹musyrifah@uum.edu.my, ³zul@uum.edu.my

²University of Wollongong Dubai,
Block 15 Knowledge Village,
P.O. Box 20183 Dubai, U.A.E
shafizmohdaffendi@uowdubai.ac.ae

ABSTRACT

Despite the growing literature on Open Source Software (OSS) innovation, knowledge about gender issues within the OSS innovation process is inadequate. This paper begins with some introduction on OSS innovation process, it then continues with the discussion of the current problems on gender and OSS innovations. The paper argues that appropriate feminist approach may be useful in augmenting the understanding of OSS innovation process through the lens of social constructivist's theory. Finally, the paper summarized with some preliminary consideration of how these concerns may be applied to OSS innovation process.

Keywords

Open Source Software, SCOT, Feminist Approach

1.0 INTRODUCTION

The gender problems in OSS innovation seem to be a continuation from the existing issues on women in software and technology industries (Lin,2005a). Under-representation, discriminations 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, 2005a). 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 Information Technology (IT) might differ depending on the gender of the designer and users (Rosser, 2005).

Although OSS innovation process has offered a different set of practices from traditional software development with its philosophy of 'freedom' (like

freedom of speech', not 'price') which has changed the way software is developed has still duplicated most of the gender problems in software industry (Lin, 2005a). Despite fewer obstacles to be involved in OSS innovation as compared to proprietary software industry, women seem to be underrepresented in its development and are still being driven out of OSS communities, usually by the unconscious sexism of well-intentioned men (Lin, 2005b). OSS survey and report (Ghosh, Glott, Krieger, & Robles, 2002; Nafus, Leach, & Krieger, 2006) stated that there is a great gap between genders where less than 2% are female contributors in OSS development. Another study in Australia reported only 7.3% are female (Vaugh Partners, 2008) which are slightly higher than the previous OSS report, but still noticeably reflects very low involvement of female in OSS innovation. This phenomenon of social dynamics demonstrates that OSS is a thoroughly male dominated world where women do not play a role in OSS innovation (Lin,2005a; Nafus et al., 2006).

Most of the researches in OSS focus on the process and structure of OSS related organizations and management while only a few of the researchers found that gender biasness in OSS is problematic (Lin, 2005a). Neglecting the inclusion of both sexes actually hinders the full potential of OSS since software is gendered in its design and usage (Lin,2005a). The lack of female OSS developers results in a large numbers of female unfriendly software where women's perspectives on software design and usage are not accounted in. Thus, not only the reasons behind the scarce numbers of female developers in OSS development should be investigated but to also find out 'what', 'why' and 'how' women plays their role in contributing to OSS innovation. This will help to prepare OSS community to be a more welcome environment that can attract women to participate in its development.

In the next section, a brief overview of OSS phenomenon shows the complexity of social dynamics including gender issues will be provided. Next, arguments that OSS phenomenon and innovation process involves socio-technical elements are elaborated followed with discussion on social constructivist's theory and arguments of the need to incorporate feminist approach in OSS innovation. A conceptual framework incorporating the social and gender issues to OSS innovation process is proposed at the end of this paper.

2.0 OSS PHENOMENON

OSS movement has increased rapidly in recent years with the development of information technology and the internet. The rapid growth of OSS movement is due to the large amount of attention from the computing society, academicians and also many governments around the world that are actually supporting the movement toward OSS. OSS is different from proprietary software in term of its freely accessible source code that make it possible to share, study, modify and customize the source code for further potential innovations without monetary cost (Dempsey, Weiss, Jones, & Greenberg, 2002). The availability of OSS's source code to the user helps them to comprehend how the program works and thus improves the interaction between developers and users that is important in OSS innovation and maintenance. This phenomenon reflects that OSS is shaping the society in several significant ways that includes computer science society in reviewing the software engineering and practices, and also stimulate social researchers to look at the phenomenon of volunteerism, motivation in working as a team from globally distributed individuals in software development (Lin & Risan, 2007).

The striking difference of OSS from the traditional and modern software engineering practices is that OSS are developed using Open Source (OS) methodology. It consists of a set of principles and practices that based on the contributions of shared knowledge that is transmitted during collaborative engagement from worldwide distributed contributors via the internet (Gacek & Arief, 2004; Stallman, 2007). The contributions from volunteers regardless of gender, race and cultural (Scacchi, Feller, Fitzgerald, Hissam, & Lakhani, 2006) in the communities can vary from source code, testing the software, finding and fixing bugs, preparing documentations and posting discussions on the bulletin board or forums (Christley & Madey, 2007). OSS community of contributors involve a heterogeneous field where innovation is socio-technically constructed based on the interpretation of practices and norms in the OSS community (Lin, 2004).

3.0 OSS INNOVATION PROCESS

In OSS software innovation, the phases in the innovation process cannot be clearly distinguished as in proprietary software development. OSS innovation is no longer limited to the experts or certain firms but shift to public openness where a promised incentive is not the motivation factors for innovation. As a consequence, the behavior of innovation has transformed progressively from independent innovation to spontaneous and unconscious innovation (Hao, Zhengang, Chunpei, & Zhuo, 2008).

There are many existing definitions on innovation. Schumpeter, the founder of innovation theory defined innovation, as stated in (Wang & Chen, 2005): "the commercialization of all new combinations based upon the application of: a) new materials and components; b) the introduction of new processes; c) the opening of new markets; or d) the introduction of new organizational forms. However, innovation in OSS community differs significantly from the founder of innovation theory definition in terms of the relation of innovation with commercialization since not often OSS being commercialized as compared to proprietary software (Wang & Chen, 2005). Still, in correspondence to Schumpeter's definition, innovation in OSS can be regarded as a combination and application of new components and match up the definition by Duggan (1996): "the successful exploitation of new ideas". This definition is very broad but still corresponded to the innovation theory by Schumpeter since it does identifies the same two characteristics of innovation, to be exact innovation has to do with something that is new and something that is exploited (de Joode, 2004).

4.0 GENDER ISSUES

The biasness and inequality issues in OSS innovation occur not only to gender but to other minorities who are not involve in coding such as business and marketing people, and also users (McPherson, 2009). It reflects that the strong programming culture in OSS development and implementation seems to be enjoyed only by hackers that are capable of manipulating technologies thus created imbalanced population of OSS based knowledge demography and unbalanced proportion of gender distribution (Lin, 2005b; 2006b).

The strong programming culture in OSS innovation somehow hinders women participation in its innovation where women are more likely to contribute in writing documentation and reporting bugs. Ignoring the large disproportionate of male and female developers hinders technology to its most potential since technology will be a gendered artifact. This is true if the key specialist actors

especially in the engine room of its development are predominantly men (Faulkner, 2000) like the cases of OSS innovation process.

The heterogeneity of reasons in contributing to OSS development related to human aspect reflect that diversity of people consequently cause essential differences within OSSC as a whole (Ghosh et al., 2002) thus influence the construction of OSS innovation. The success of OSS innovations does not rely on the great programmers alone, but to the whole community of volunteers in reporting and fixing bugs, doing graphics and documentation and spreading it others, but this is not to suggest that women are not good in programming. Thus, in order to mitigate the unbalance proportionate of male and female in OSS innovation process, a feminist perspective is needed to treat the whole mechanism of OSS innovation as a socio-technical system (Lin, 2006a).

5.0 SOCIAL CONSTRUCTIVIST VIEW

The Social Construction of Technology (SCOT) theory is a social constructivist's views that see the developmental process of a technological artifact is described as multidirectional views of technological development as contrast to the linear models that follows pre-specified steps used explicitly in many innovation studies, and implicitly in many of the history of technology studies (Pinch & Bijker, 1984). SCOT believes 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 concept emphasized that the members need to be using and sharing the same set of meanings on a certain technological artifact in order to be considered 'relevant.' The RSGs can be institutions and/or organization of groups of individuals (be it organized or unorganized) that assign similar meanings to a particular technological artifacts. A problem is defined as such only when there is a RSG for which it makes up a problem.

Interpretive flexibility in SCOT means that not just how people interpret or assign meanings to an artifact flexibly, but flexibility exists in how the artifacts are designed. SCOT's second concept 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 emerges when interpretive flexibility decreases that shows the meanings given to an artifact is becoming more stable and less vaguely. 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 (inter-group). Finally, the artifact become ground and stabilizes around the dominant interpretation.

A Technological frame is the concept on sharing similar interpretations of an artifact within RSGs. That is crucial since if it does not exist, there will be no RSG and future interactions. This concept suggests that each member of the RSGs has similar interpretations and assigned same meaning towards an artifact. It 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.

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)

5.1 Critics of SCOT Regarding Gender

Although, SCOT seems to cover all the social ramifications in the technology development study, gender is an issue that has been largely ignored in most of constructivist studies of technology and innovation including SCOT. Generally, SCOT has particular problem in its methodology in addressing the gender divisions where its analyses begin with the actors who directly involved with innovation. This analysis in return generates difficulties in explaining the influence of broader social structures and why some actors are excluded or marginalized and why some actors and outcomes may be absent (Wajcman, 2000; Williams & Edge, 1996).

The issues indicate a general problem in its methodology that relates to conception of power. The theorists in this genre were concerned about identifying and studying the social groups or networks that actively seek to influence the form and direction of technological design (Wajcman, 2000). These theories 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).

Feminists have stressed out that the absence of female in the technological development is a key feature of gender power relations. The effects of structural exclusion of actors who are excluded and marginalized on technological development should not be neglected even it is hard to analyze, as

pointed out by commentators on the problems with “relevant social groups” in the process of technological development (Wajcman, 2000).

Furthermore, these theories have generally assumed that gender has little bearing on the development of technology because the masculinity of the actors involved was not made explicit. It might be seen as ironic that the focus on agency has rarely sensitized these authors to issues of gendered.

6.0 FEMINIST APPROACH

Both men and women have gender identities which structure their experience and beliefs that need a full understanding of theoretical integration of genders in technology studies (Faulkner, 2000; Wajcman, 2000). Most of feminist scholars in the field of technology studies view technology as socially constructed and genders plays a role in its production (Faulkner, 2000). To conform to feminist view on representation of technology is sharply gendered, Wajcman (2004) has stressed in her book that every aspect of technology in human lives is a socio-technical system which is gendered and unless women are part of the team of technological development, only then women have their level of power to touch the socio-technical aspect.

Cockburn and Omrod (1993) and Wajcman (2004) have laid two important foundations on feminist technology concept. The first is there are existence of mutually shaping relationships between technology and gender which technology is a source and the outcome of *gender relations* and *structures* or vice versa. 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). Thus, the technological development approach should not focus solely on women per se, but the social construction relations between both genders. Gender relations also recognize 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).

Second foundation on feminist concept is *gender identities* and *symbols* since gender-technology relations are apparently not only exist in gender relations and structures, in other words it is about how we go as regards for being men and women. Faulkner (Faulkner, 2000) stated, close identification with technology and pride engineers have in technical competency are crucial elements towards individual identities and shared cultural of engineers of a technology development. The pleasures which

men have more in technology as compared by women are an important factor in the dominance of technical work. It captures the notion of socio-technical in technology development that social and technological elements are mutually constituting and hence the so-production of 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.

7.0 CONCEPTUAL FRAMEWORK

The conceptual framework of Social-OSS innovation in OSS community shown in Figure 1 represents the theoretical guide for studying social construction of OSS innovation with gender elements. The framework shows the proposed relationships among the constructs of interest as derived from SCOT and feminist theories. Since, SCOT did not acknowledged technological influences in determining the construction of technology (Pinch & Bijker, 1984), there is the need to incorporate technology use influence in the framework since the nature of OSS development is mostly relies heavily on computer-mediated communication (Crowston, Annabi, Howison, & Masango, 2005; Crowston, Wei, Howison, & Wiggins, 2009). Crowston et. al (2009) discuss *technology use* as a very important input variable to an OSS project since the type of technology use by contributors in OSS community is very crucial in coordinating their OSS development activities that has significant impacts on the software development. The influence of the features offer by technology use have impacts on the OSS development in terms of sharing of knowledge and creation of software innovation (Crowston et al., 2009). Thus, the concept of technology use is necessary to facilitate the four concepts of SCOT theory in understanding the construction of OSS innovation.

The constructs of feminist theory are incorporated in this conceptual framework, the *gender relations and structures* that shows the power relations between genders and minorities along with *identities and symbols* embedded in respect to gender to overcome the SCOT weakness since it is blind toward societal power relations (Russell, 1986). In OSS innovation different actors and RSGs can possess different power where SCOT only recognizes the only *relevant groups* that have active roles towards the construction of technology thus, groups without great power such as female or other minorities or the so called “irrelevant” social groups may have been unknowingly underrepresented and intentionally ignored during its design (Winner, 1993).

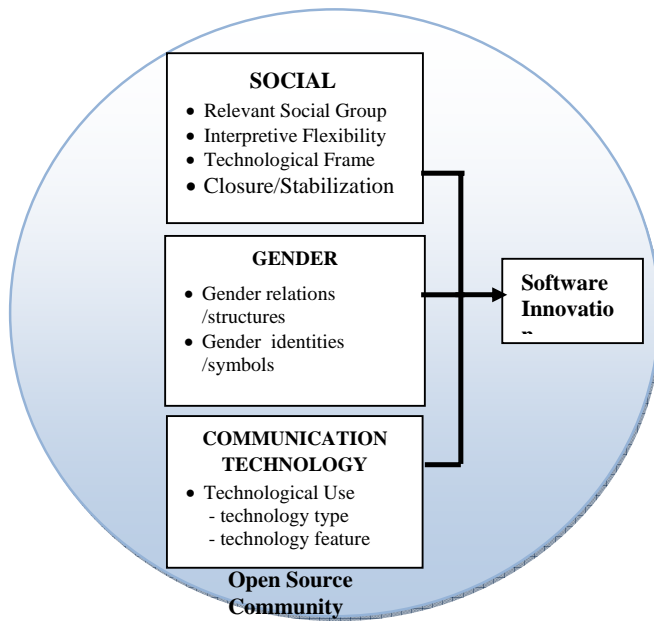


Figure 1 Conceptual Framework of Social-OSS innovation in OSS community

8.0 SUMMARY AND FUTURE WORK

This paper has demonstrated the gender issues in OSS innovation process and the need to incorporate feminist perspectives in OSS innovation process through social constructivist view since software innovation in OSS communities employs new types of socio-technical practices, development processes, and community networking when compared to proprietary software innovation in industry. The very low percentage of less than 2% of the software developers in OSS community are female, it is an urgent need to realize the proposed conceptual framework in real phenomena study.

This conceptual framework incorporates SCOT theory, Crowston et. al (Crowston et al., 2009) technology use variable and feminist approach can therefore make an important contribution generally to Information System and STS research and highlight the need to draw on the theoretical foundations of OSS innovation discipline. We believe that this study will offer insights on how genders play a role in contributing to the construction of software.

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