International Journal of Academic Research and Development
ISSN: 2455-4197
Impact Factor: RJIF 5.22
www.academicsjournal.com
Volume 2; Issue 6; November 2017; Page No. 1223-1225

Exploring motivation factors driving free/open source software volunteers

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Abstract
Internet technology has emerged as a tool of change in terms of the way technical as well as non-technical communication takes place. In turn, it has made distributed and decentralized development of software projects especially Free/Open Source Software (F/OSS) possible. The F/OSS form of development has become a revolution which has affected the way individual users as well as enterprises think about the development and use of various software projects ranging over a wide area of applications. The F/OSS development approach allows establishment of geographically distributed teams of volunteers who self-learn and self-organize in order to contribute towards developing software projects. As the volunteers may not anticipate receiving direct remuneration for their efforts, it gives rise to questions regarding the factors of motivation leading towards such voluntary contributions for achieving shared goals. This paper reports on a literature survey aimed at exploring and identification of motivation factors driving volunteers of F/OSS projects.

Keywords: free software, open source software, F/OSS, motivation

1. Introduction
Internet technology has emerged as a tool of change in terms of the way technical as well as non-technical communication takes place. In turn, it has made distributed and decentralized development of software projects especially Free/Open Source Software (F/OSS) possible. The past two decades have seen evolution and unprecedented success of some of F/OSS projects like, Linux and its variants, Apache, Mozilla Firefox and MySQL which are being famously adopted by individuals as well as enterprises. The F/OSS form of development has become a revolution which has affected the way individual users as well as enterprises think about the development and use of various software projects ranging over a wide area of applications. The F/OSS development approach allows establishment of geographically distributed teams of volunteers who self-learn and self-organize in order to contribute towards developing software projects. As the volunteers may not anticipate receiving direct remuneration for their efforts, it gives rise to questions regarding the factors of motivation leading towards such voluntary contributions for achieving shared goals.

2. F/OSS Development Model
F/OSS software development model, which depends upon contributions by volunteers sharing knowledge, is being represented by two different terms namely, “Free Software” and “Open Source Software”. Official definitions of Free Software and Open Source Software define the various aspects related to their use and distribution [1, 2]. The very subtle difference between Free Software and Open lies in the fact that Free Software is taken as a social movement concerned with liberty and not the price whereas Open Source Software is a development methodology. Free Software ensures that the user always has the freedom to use, copy, modify and distribute the original as well as the modified versions, regardless of the mode i.e. free or paid, of acquiring it [1]. Open Source Software may incorporate certain licensing agreements restricting the way in which the code, which is freely and publicly available, can be used [2]. F/OSS is a broad term which is used to encompass both the Free Software and the Open Source Software. F/OSS development model depends upon readily available co-operative modes for producing software for use, distribution and re-use by community of volunteers. It lacks a well-defined project development and management plan due to its open nature in terms of volunteers, time schedules, infrastructure and requirements. The volunteers may perform different roles (developer, maintainer, user, version release coordinator) suiting their skills, use their own infrastructure and may have variable time schedules for F/OSS development activity. The software requirements themselves are dynamic in nature as they depend upon the needs of both the developers and the users, both of which may change during project evolution.

3. Research Aspects of F/OSS
The F/OSS development process is dynamic in nature, i.e., the requirements keep changing as the project evolves depending upon the needs of the developers as well as the users who may contribute in terms of feature requests. The volunteer pool itself is dynamic and keeps changing as the project progresses. New contributors may join an ongoing project and some existing ones may leave due to various reasons leading to difficulty in ascertaining the total effort expended in terms of man-hours. The volunteers use their own resources and may or may not get any remuneration for their collaboration towards building a project, thereby causing questions related to cost analysis of such projects. The volunteers contribute as per their own time schedules and skills. Thus, the F/OSS

model of development lacks the project planning and management as compared to the traditional closed development model. This may fundamentally change the overall economics of the software development industry as it directly affects the overall structure and the incentives paid to programmers. Also it would greatly influence the product markets, and the business models and strategies used by the traditional software industry. Research is being undertaken to understand motivation to contribute in F/OSS projects and the various roles taken up by the volunteers.

4. Methodology

F/OSS projects rely upon contributions from motivated set of developers who are generally skilled and experienced professionals contributing their time and effort for building software products with or without being paid for the same. With the enormous large scale success of some of the F/OSS projects, the supporters of closed source development have tried to determine the factors leading to such success. As a result, F/OSS development methodology becomes a social as well as economic phenomenon. Literature review has been carried out to gain insight into the factors which lead towards motivating the volunteers towards contributing in F/OSS projects.

5. Volunteers' Motivations - Literature Review

Raymond has described the main concepts of F/OSS development in 'The Cathedral and the Bazaar' which takes a successful open source software project and uses its evolution to explain the 'Bazaar' or 'Open' model of software development as compared to the 'Cathedral' or 'Closed' approach. This paper introduces an important lesson that the developer's own need for a particular service or application is the foremost factor of motivation for voluntary work and its progress [3].

Lerner and Tirole have taken into account the economic considerations as part of motivating factors for contribution towards either Closed or F/OSS projects. They identified the net benefit to developers as sum of immediate-payoff (include monetary benefits of working in a commercial firm, direct benefit derived from customization solutions and enjoyment in the job) and delayed-payoff (include career incentives i.e. future job offers, peer recognition and public relations) [4].

Hars and Ou have classified sources of motivation of developers for participating in F/OSS development as internal factors and external rewards. Internal factors include -i) intrinsic motivation i.e. the need for competence, satisfaction and fulfillment of goal attainment, ii) altruism i.e. to selflessly increase the welfare of others and iii) community identification i.e. helping kinship partners to achieve common goals. The external rewards include –personal needs of software, skill development leading to increased marketability, increase in human capital level leading to better job opportunities with higher salaries, peer recognition and revenues generated from related software[5].

Ghosh et al. conducted an online survey of developers to identify the motives of developers involved in F/OSS development from two perspectives – motive behind joining and motive behind staying in the F/OSS project. The factors include both social as well as political motivations. The social motivation comes from the need to i) generate new ideas, ii) learn and develop new skills, iii) share knowledge and skills, and iv) earn reputation by improving the existing software and resolving issues which could not be solved by proprietary software. Political motivation arises from the intent to limit the power of large proprietary companies leading to a fair competition [6].

Ye and Kishida observed that learning by gaining knowledge-in-action forms the major motivational force for F/OSS developers. By actually engaging in practical tasks i.e. participation in F/OSS projects allows the volunteers to apply their existing knowledge and also enhance their skills. This acquired learning then facilitates future contributions and role transformation amongst the volunteer community [7].

Lakhani and Wolf used a web based survey to learn the motivation factors behind the participation. They classified intrinsic motivation as –i) Enjoyment-based intrinsic motivation (pursued for the sake of fun, creative discovery and challenge of resolving a difficulty) and ii) Obligation/ Community-based intrinsic motivations (Social aspects). Extrinsic factors include solving a problem for direct use of software in specific field of application, skill improvement and career advancement opportunities [8].

Roberts et al. classify motivations as: i) pure extrinsic - incentives, ii) internalized extrinsic which are use-value and status-related, and iii) pure intrinsic - based on psychological need for competence, control and autonomy [9].

Oreg and Nov differentiated the motivational aspect as context dependent where the contexts explored were: subject (i.e. software) and content (i.e. body of knowledge). A web based survey resulted in the observations that the volunteers who are software contributors put more emphasis on reputation building (for sense of achievement) and self development (growth, autonomy and free thinking) whereas the volunteers who contributed towards content were driven by altruistic motives (others' welfare) [10].

Battistella and Nonino categorized the motivations as Intrinsic (Individual - driven and Social - driven) and Extrinsic (Economic - driven, Professional - driven and Social - driven). Intrinsic individual - driven motivations include: entrepreneurial mindset, creativity, sense of membership, enjoyment, psychological compensation and sense of usefulness. Intrinsic social - driven motivations include: sense of cooperation and social responsibility. Extrinsic economic - driven motivations include: monetary rewards, free products and services. Extrinsic professional - driven motivations include: learning, reputation, career benefits and reciprocity. Finally, Extrinsic social - driven motivations include: Individual accountability and social capital [11].

Hannebauer and Gruhn took newcomers as target population of volunteers to study the factors driving them towards contributing in F/OSS development. They classified them as Technology learners, Joy programmers deriving joy from programming, Pragmatic patchers who are motivated due to their own use of modifications, and Community joiners who regard social interactions as their motivation to volunteer for F/OSS development [12].

6. Conclusion

Thus, from the literature review, it has been observed that

there are several motivating factors which lead to participation of volunteers in F/OSS development. From the literature, the common motivational factors identified are: Problem solving for self directed use and creative discovery, technology learning for skill enhancement, knowledge sharing for community benefits, peer recognition for better career opportunities, and fight against proprietary software. It expands the career choices for potential programmers. Moreover, the degree of motivational factors are also driven by the context in which the volunteer has joined the F/OSS project development.

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