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# Tracking the Mindset of Open Source Participation: a Research in Progress

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## ABSTRACT

The objective of this research is to identify the motivation structure of participants (i.e. developers and administrators) in Open Source Software (OSS) community from two social groups -- those non-professional that mainly consist of students and those professional that mainly consist of software developers employed by companies or self-employed. We explore the hierarchical structure of motivation using a method derived from Gutman's Means-End Chain (MEC) model. Using data collected from over 45,000 projects hosted on Sourceforge. A total of 146 projects are selected. A two-stage research was conducted. By comparing the motivational structures from professional and non-professional groups, this research has potential to provide aspirations to managers in the commercial software production sector on designing more effective incentive schemas. It also has the potential to provide practical suggestions on incentive structure of knowledge worker in knowledge management industry in general.

## Keywords

Source Software Development, Mean-End Chains, Motivation Factors

## INTRODUCTION

Open Source Software can be referred as a range of software developed under "open source" license like GNU, which does not restrict its use, modification and redistribution by third parties. As its name indicates, all open source software's source codes are publicly available for inspection.

The emergence of high quality Open Source Software (OSS) has attracted considerable attention in recent years, primarily because it has the potential to provide a viable, non-proprietary, and socially beneficial model of software development. The emergence of successful OSS projects has demonstrated that developers distributed geographically dispersed, without going through a conventional selection process to be involved in software production, and most of all, without being paid, can still build high quality software that most of the time even better than those produced by their commercial counterparts. The model behind OSS is that large and complicated software like Linux could emerge when dedicated community of developers can freely read, redistribute, and modify the source code. The success of OSS not only relies on the willingness of programmers to contribute but also on the enthusiasm of users to find out bugs and report.

The main focus of this research is to investigate why people participating OSS development. The motivation of OSS participation is a phenomenon that cannot be simply explained by conventional management theories being widely used to explain commercial software production. Despite the fact that there are a few theoretical and empirical analyses on the "incentive of participation" in OSS development, most of these researches have been focusing on a linear model of motivation. We argue that a linear model is inadequate to portray how different incentives are interplaying especially how these incentives are connecting with inner motivations and personal value orientations.

We first review previous researches on motivation of OSS participation then propose a research design to explore the hierarchical structure of motivation of OSS participation. Preliminary result is indicated.

## LITERATURE REVIEW

The literature of motivation on OSS can be summarized in two broad streams: those coming from economic perspective and those from social and psychological perspective.

### Economic Perspective

The economic perspective concur the incentives into two sources: signaling and demand driven.

Signaling is a frequently used measure to assess the quality of credence goods like potential of employee. According to Lerner and Tirole (2002), signaling can be a major incentive for OSS participation. This signaling incentive can be further differentiated into two categories: career concern incentive and ego gratification incentive. Career concern incentive refers to “future job offers, shares in commercial open source-based companies, or future access to the venture capital market”, and ego gratification incentive stems from a desire for peer recognition (Raymond 1999b). Similarly, Lee et al. (2003) show that the way OSS projects use to credit their individual contributors would allow the best programmers to create a signal that more mediocre programmers cannot achieve. Furthermore, they argue that such contribution as signal of superior capability can turn into monetary reward in the future.

In relation to demand driven, Green (2002) proposes that “filling an unfilled demand” is the primary reason for the participation of OSS projects. Usually when certain software is needed by some users but uneconomical for industry level production, Internet provides a medium to allow these users to work together and build what they want.

To confirm the existence of economic returns to participation in open source development, Hann et al. (2002) surveyed on Apache project developers in US. They found that employers do not reward the accumulation of experience in open source projects. Rather, higher open source rank is associated with higher wages, even when controlling for work experience and programming experience. This is consistent with the notion that firms make inferences about productivity differences based on the rank of the contributor. It gives an important insight that: firms use verifiable rank within an open source project as a signal for hard to observe characteristics of a programmer such as the productivity capacity, the tenacity to convince others of the design, or the ability to motivate others to contribute to the specific project.

### Social and Psychological Perspective

From social and psychological perspective, Krogh et al. (2003) investigated the sufficient conditions to mobilize programmers to freely contribute to OSS project through a comprehensive case study on Freenet. They conclude that the “production process of knowledge in an open source software project has as a byproduct communal resources that reward its contributors.” And these rewards (communal resources) are reputation, control over technology, and learning opportunities. So basically, these rewards serve as the incentives for the participation of OSS.

If we regard software development as an innovation process, then theory related to incentive for innovation can be introduced to explain OSS participation. There are two models to encourage innovation from society: private-investment model and collective action model. The example for former is invention funded by personal investment and for latter is the contributions of scientific researcher in the world. So Hippel and Krogh (2003) proposed a new “private-collective” innovation model to explain the incentive of OSS participation. They found that OSS development is a model that “contains elements of both the private investment and the collective action models and can offer society the ‘best of both worlds’ under many conditions.” This view is similar to Raymond’s argument of “gift economy” – the motivation of OSS participation is similar to motivation of scientific research on the condition that developers like researchers are guaranteed living support (Raymond 1999a). Actually, early OSS developers are themselves researchers.

There are also novel explanations from senior OSS participants directly. For example, Perens (2003), a senior strategist for Linux and open source at Hewlett-Packard, explains that programmers are like artists. They derive gratification from lots of people using their work. This is because “Writing software that just gets put away feels like intellectual masturbation. All of the good comes from someone else participating.”

## Other Perspectives

There are a few empirical researches on the motivation of OSS that integrate incentives from both economic and social-psychological perspectives though they may use different categorization methods like internal and external in Hars and Ou (2000, 2002) and seven social motivational factors in Hertel et al. (2003).

Specifically, Hars and Ou (2000, 2002) classified the source of motivation into three different functions: (1) those who intrinsically motivated to write programs (self-determination, altruism and community identify), a mixture of arguments by Krogh et al (2003), Hippen and Krogh (2003), and Perens (2003) and (2) those who program for their personal and work-related needs (personal need), same as demand driven by Green (2002) and (3) those who treat developing open source software as a form of investment and expect future returns (selling products, human capital, self-marketing, peer recognition), same as signaling theory proposed by Lerner and Tirole (2002). According to the survey result on 389 participants, they find that although internal incentives do play a role, external factors like building human capital, self-marketing as well as personal need for a software solution carried a greater weight relatively.

In contrast, Hertel et al. (2003) consider OSS project as a social movement so the motivations for developers participating OSS is similar to those participating other social movements like civil rights movement. They identified seven motivational factors: (a) a more general identification factor as Linux user, (b) a more specific identification factor as a Linux developer or with a Linux subsystem, which related to “communal resources” by Krogh et al. (2003) (c) pragmatic motives related to the improvement of one’s own software and career advantages, which corresponding to signaling incentive in Lerner and Tirole (2002) (d) norm-oriented motives related to reactions of relevant others (family, friends, colleagues), again related to “communal resources” by Krogh et al. (2003) (e) social and political motives related to supporting independent software and networking within the Linux community, related to “private-collective” model by Hippel and Krogh (2003) (f) hedonistic motives such as pure enjoyment of programming, related to Perens (2003) (g) and motivational obstacles related to time losses due to Linux-related activities, somehow related to demand driven by Green (2002).

## METHODOLOGY AND RESEARCH DESIGN

In the context of exploring the motivation behind OSS developers, we argue the current existing literatures have been exclusively focused the “linear” structure of the motivations – that is the relative weight and impact of motivational factors on OSS participation. Although these linear models can provide certain level of insights on which factors are important, they are insufficient to explain the relationship and evolvment among these motivational factors. Many of them also failed to address the diversity of motivations among OSS developers like that students are more internally motivated while salaried and contract programmers are more externally motivated (Hars and Ou 2002). According to a recent article (Glass 2003), there are at least four levels of participant in OSS society. They are methodology gurus, product gurus, contributors and code readers. It is quite possible that the motivations of participation are quite different for members in different status.

Therefore, we attempt to hypothesize a *hierarchical* structure of motivation on OSS project or the leveled motivation factors in different social groups. The existence of hierarchical motivation in general is not a new concept and can be dated back at least to Maslow’s theory of hierarchical human motivation (Maslow 1943). In the context of OSS participation, our hierarchical structure focus more on identifying the relationship between incentives of participation, expected benefits from incentives, and personal value related to these benefits. By identifying different abstraction level of motivation, namely incentive, benefits, and personal value, we can eventually find a common level of motivation with software development in commercial sector as well as other knowledge management industry. We can also compare the motivation structure between different social groups so as to get more insightful information.

To investigate the hierarchical structure of motivation factors, we adopt a widely used technique in marketing research called means-end chain theory (Gutman 1982). Means-end chain theory is based on expectancy-value theory (Edwards 1954, Fishbein and Ajzen 1975, Rosenberg 1956). It assumes that values, which defined as desirable end-states of existence, play a dominant role in guiding choice patterns. People cope with the tremendous diversity of products that are potential satisfiers of their values by grouping them into sets or classes so as to reduce the complexity of choices. The model was originally developed for marketing research in advertising. It is gradually being introduced in IT research to investigate cognitive structure of human mind in online environment (Aschmoneit and Heitmann 2003).

The sample of this study is the participants of OSS projects downloaded from SourceForge.net website on 1<sup>st</sup> October 2003. 146 out of 45654 projects were selected as target sample based on three criteria: Registered between July 2000 and December 2000, Ranked at 70 percentile or above, consisting of 5 or more members.

The whole research is conducted in two stages: subject identification and online chatting. In stage one, we sent out online survey solicitation to developers of sourceforge by asking them their current status (student or working professional) and

direct motivation of OSS participation. Feedbacks are codified and categorized. In second stage, we will conduct online chatting with respondents based on their statements of motivation to find out their value chain for OSS participation. The methodology used in chatting for solicitation is described in Gutman (1982). Chatting will be recorded and transcribed. A means end chain map for both students and working professionals will be drawn based on information collected from codification of transcription.

## RESEARCH PROGRESS AND CONCLUDING REMARKS

According to stage-one survey responses we received so far, there are not only confirmations of existing motivation factors but also emergence of new motivation factors.

This is a novel research aims at exploring the hierarchical motivational structure of OSS participation. It covers a large variety of OSS projects and the result should have a very high level of external validity. We hope to provide insightful findings and aspirations to future research in incentive design of IT professional in software engineering as well as in other knowledge management industries.

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