December 2006

Assessing the Impact of Project Founder Reputation and Project Structure on Motivation to Participate in Open Source Software Projects

Kaushik Ghosh
The University of Mississippi

Jennifer Ziegelmayer
The University of Mississippi

Anthony Ammeter
The University of Mississippi

Assessing the Impact of Project Founder Reputation and Project Structure on Motivation to Participate in Open Source Software Projects

Kaushik Ghosh
The University of Mississippi
kghosh@bus.olemiss.edu

Jennifer L. Ziegelmayer
The University of Mississippi
jziegelmayer@bus.olemiss.edu

Anthony P. Ammeter
The University of Mississippi
tammeter@bus.olemiss.edu

ABSTRACT

Previous literature on Open Source Software (OSS) indicates that participation in Open Source projects is not random; for example, "Band-wagon" dynamics, altruism, and technical need in the workplace have been shown to impact individual decisions to participate in OSS projects (Hars and Ou, 2002; Madey, Freeh and Tynan, 2004). Various characteristics of the developer and the project may encourage developers to choose certain projects over others, given the same internal motivating factors. This study investigates the role of the importance of future career benefits to the developer and the developer's OSS ideology in determining the level of participation in OSS projects. We also investigate the moderating role of two factors, project founder reputation and project structure, on developer participation. We propose that a founder's reputation for developing a meritocratic culture and espoused OSS ideology as well as a project's level of decentralization and layered development structure impact developer participation.

Keywords

Open Source Software; Developer Motivation, Founder Reputation, Project Structure, Open Source Ideology

INTRODUCTION

Previous literature on Open Source Software (OSS) has analyzed the role of individual motivations that drive developers to participate in OSS projects. Lerner and Tirole (2005) have suggested the concept of signaling, in which an individual's contributions result in professional recognition and enhanced future job opportunities, as a reason for developer participation. Several studies have suggested intrinsic motivations such as altruism and personal gratification as the basis for developer involvement (Hars and Ou, 2002; Hertel, Niedner and Herrmann, 2003; Lakhani and von Hippel, 2003; von Hippel and von Krogh, 2003). Others have suggested a diverse set of factors, both intrinsic and extrinsic, while investigating participation (Hars and Ou, 2002; von Hippel and von Krogh, 2003). In addition, motivating factors of individuals are expected to vary depending on the stage at which they join the project (Bitzer, Schrettl and Schroder, 2004; Hertel et al., 2003).

Of interest in this study is the impact of the reputation of the project founder and the project structure on developer motivation. West and O'Mahony (2005) suggest that prestige of the project founder could influence the extent of individual participation, with more prestigious founders attracting more individuals. Similarly, project structure can lend certain opportunities or barriers to developers. The purpose of our study is to look at how the reputation of the founder of an OSS project and the project's structure moderate the relationship between the motivating factors and individual involvement in OSS projects (see Figure 1).

FUTURE CAREER BENEFITS

It is purported that the proponents of the OSS phenomenon are driven by ideological motives (e.g. altruism, fight against commercial software). In addition, there are extrinsic motivations for participation in OSS culture. One of the principal motivations is future career benefits. The traditional view of OSS projects is that they follow a "meritocratic culture" incorporated through a high quality peer review system that decides rank and status of the member based on the extent of involvement in the project (lines of code written, quality of code contributed to the project) (Gacek and Arief, 2004; Hann, Roberts, Slaughter and Fielding, 2004). This recognition of the programmer's contribution to an OSS project is an efficient way to establish competence relevant to professional abilities and programming skills (Hars and Ou, 2002; Ljungberg, 2000).

The status and respect earned by the programmer/contributor is not only restricted within the OSS community (peer recognition), as the contributions of individuals and the consequent status gained are visible to people outside the OSS project/OSS community. As commercial firms and/or venture capitalists become aware of the talent of the individual (Franck and Jungwirth, 2002; Gacek and Arief, 2004), the individual could be rewarded with future job offers, shares in open-source based companies, or entry to venture capital markets (Lerner and Tirole, 2005). Participation provides a validation of their skills and creates a window of opportunity for future career/monetary rewards.

H1a: Importance of future career benefits to the developer will positively impact the developer's decision to participate in an OSS project.
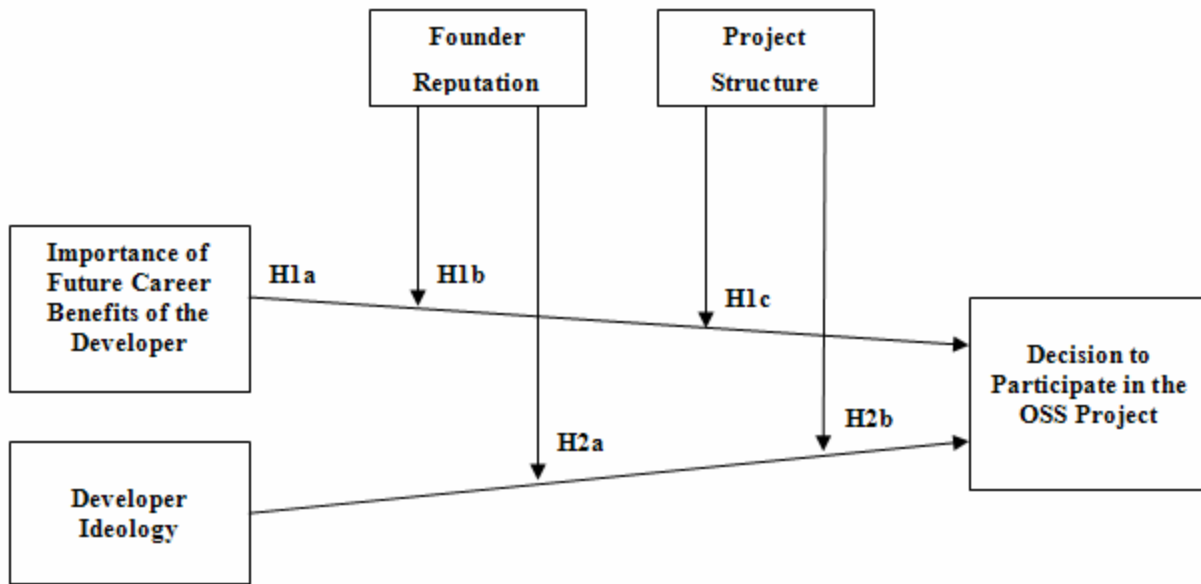

Figure 1: Conceptual Model

FOUNDER REPUTATION

While analyzing individual participation and the OSS project structure, some studies have raised the issue of the role that a project founder plays in OSS projects. West and O'Mahony (2005) suggest that reputation of the project founder could have considerable influence on the extent of individual participation, with more prestigious founders attracting more individuals. Ljunberg (2000) indicates that contributors being drawn to the project by the founder is commonly observed in growth patterns of OSS projects. The founder of an OSS project is recognized as the primary controller by its group members (Bergquist and Ljungberg, 2001). Individuals will have more confidence in founders who are well respected in the OSS community, and hence will be more likely to join the project. Missing from the literature is the mechanism through which reputation influences participation.

According to Franck and Jungwirth (2002), peer recognition earned by contributing to an OSS project could signal various professional abilities of the developer. A project which has a reputable founder and good programmers is considered to be prestigious, in part because of their adherence to the strict meritocratic culture mentioned earlier. A founder may gain a reputation for leading projects that adhere to this culture. We propose that an individual who values future career benefits will have a greater desire to participate in an OSS project having a founder with a reputation for building a meritocratic culture. The mechanism in this case is the expectation of future benefits of working in such a system, where the peer review or feedback system will validate his or her competence to a larger audience which includes future employers and/or venture capitalists and the expectation of subsequent future monetary rewards.

H1b: The positive impact of importance of future career benefits to the developer on the developer's decision to participate in an OSS project will be increased by the reputation of the founder for building a meritocratic culture.

PROJECT STRUCTURE

Two characteristics define the structure of open source communities: the meritocratic structure mentioned previously and the balance of (de)centralization (Gacek and Arief, 2004). Many projects organize in a role-hierarchy based on contribution to development (Gacek and Arief, 2004; Mockus, Fielding and Herbsleb, 2002). This "layered meritocracy" approach centers on a small group of core developers who control the project. Surrounding this group are co-developers, code readers, bug-reporters, and passive users (Crowston and Howison, 2004). As a project grows, the core development group sometimes becomes a "clique" in which the core developers serve as "benign despots". In this situation, communications may become too centralized and the core too insulated from community input (Crowston and Howison, 2004). This can result in a groupthink mentality which leads to project failure. In some cases, projects that are overly-dependant on a core group of developers (such as corporate-funded projects) may not be sustainable over the long term (Crowston and Howison, 2004).

On the other hand, many projects are highly decentralized, especially in the outer reaches of the community. For example, while the core developers may make the preponderance of the contribution to the code, bug reports frequently come from a diverse group of individuals (Mockus et al., 2002). Projects that permit a great deal of participation from the community are said to have a "town council" approach (Crowston and Howison, 2004). While this method provides a great deal of input, it can prevent the project from remaining focused and decision-making can become difficult.

West and O'Mahony (2005) indicate that more modular, decentralized projects appeal to those seeking to build a reputation. Because these projects are modular in nature, there are more opportunities to become involved in a meaningful way in the subprojects. As well, Raymond (1998) indicates that centralization, often based on the concept of ownership, is critical in the gift economy and reputation-based drivers of project participation. As such, developers interested in future career benefits will be drawn to the layered meritocracies while altruistic developers will be more attracted to projects with centralized control structures built around a founder whose ideals are in concert with their own. Therefore, developers seeking to gain future career benefits are more likely to participate in projects that are decentralized and layered in structure.

> *H1c: The positive impact of importance of future career benefits to the developer on the developer's decision to participate in an OSS project will be increased by the level of decentralization and layering in the OSS project structure.*

FOUNDER AND DEVELOPER OSS IDEOLOGY

When Richard Stallman, a pioneer of the open source phenomenon, initiated the Free Software Foundation (FSF) in 1984, two overarching ideological tenets were instituted: (1) the development of free and high quality software for public use and (2) the fight against commercial software (Feller and Fitzgerald, 2002; Hertel et al., 2003; Ljungberg, 2000). Community initiated OSS projects are usually initiated by an individual. This individual is the founder and leader of the project and manages the project based on the open source culture (Hofstede, Neuijen, Ohayv and Sanders, 1990). The founder's ideology shapes the form and governance structure of the OSS project and attracts those people to the project who are driven by the same set of values and norms (Ljungberg, 2000; Markus, Manville and Agres, 2000).

Fershtman and Gandal (2004) point out that an individual's ideology could be among the grounds to understand participation in OSS projects. Similarly, the 'Extended Klandermans Model,' or EKM, mentions norm-oriented motives and collective motives among the four motivational constituents that explain the association and contribution of individuals to community projects (Hertel et al., 2003). In the framework of our study, the 'norm-oriented' and 'collective' motives refer to the common values/ideologies that a potential developer shares with the people associated with the OSS project as well as the project itself. We propose that this is a type of 'ideological consonance' whereby the values are consistent with that of the founder, other participants in the project, and the project itself.

> *H2a: The degree of ideological consonance between the developer's ideology and the founder's ideology will have a positive impact on the developer's decision to participate in an OSS project.*

Note that we do not propose a main effect relationship between developer's ideology and decision to participate. A developer may not hold the OSS ideology, yet may still participate in an OSS project because the project itself is geared towards producing products that are intended to have future financial benefits for the project participants (e.g., product installation, training, specialized support, customization, etc.). In this case, the developer's ideology is consonant with that of the founder and / or the project. We thus must recognize that the *project* may also have an ideological orientation.

> *H2b: The degree of ideological consonance between the developer's ideology and the project ideology will have a positive impact on the developer's decision to participate in an OSS project.*

RESEARCH STUDY

We are currently undertaking a research project to collect cross-sectional data on OSS projects, their founders, and their developers to test our model. We are using survey responses from OSS developers to guide our selection of OSS projects, from which we will be using secondary, or archival, data from SourceForge along with original survey data to measure each of the constructs. Prior to the initial survey, we are conducting a qualitative analysis of interviews (telephone and email) from OSS developers to fine-tune and validate our main survey. Data collected from SourceForge, the largest Open Source development community include metrics for project structure such as the ratio of administrators to developers, prestige of the founder assessed by the number of projects in which the founder is a participant, the number of projects for which the founder is the administrator, the number of high-profile projects with which the founder is associated, and the number of years the founder has been a member of the OSS community. We intend to have the qualitative analysis of interviews completed for presentation at AMCIS 2006 conference, as well as preliminary data on the main survey.

SUMMARY AND CONCLUSIONS

We have suggested ways that the importance of future career benefits to the developer and the developer's OSS ideology can determine the level of developer participation in OSS projects. We have also suggested that these factors can be moderated by a founder's reputation for developing a meritocratic culture and the founder's espoused OSS ideology. Similarly, we have proposed that a project's level of decentralization and layered development structure affects the impact of these developer characteristics on developer participation.

There are several practical implications of the research presented in this study. Organizations interested in OSS projects or would-be OSS project initiators / administrators will be aware that the probability of an OSS project with a founder and project structure that share and follow ideologies of the OSS phenomenon to attract developers will be higher or lower than the others without such characteristics. This could facilitate prediction of the level of participation in an OSS project. Consequently, such organizations and administrators/initiators may pick and choose projects that are most likely to grow and eventually succeed.

In addition, if an individual's involvement would as well depend on his/her degree of ideological consonance with that of the project's founder and the extent to which the project adheres to the practices followed by OSS projects, then organizations that wish to attract developers to the OSS projects should be conscious of the fact that future career benefits alone might not be able to draw the attention of an individual towards a project.

REFERENCES

1. Bergquist, M. and Ljungberg, J. (2001) The power of gifts: Organizing social relationships in open source communities, *Information Systems Journal,* 11, 4, 305-320.
2. Bitzer, J., Schrettl, W. and Schroder, P. J. H. (2004) *Intrinsic motivation in open source software development*, Working Paper (No. 2004/19), Diskussionsbeitrage des Fachbereichs Wirtschaftswissenschaft, Freien Universitat Berlin, Retrieved from http://opensource.mit.edu/papers/bitzerschrettlschroder.pdf.
3. Crowston, K. and Howison, J. (2004) *The social structure of free and open source software*, Working Paper, FLOSS Research, Retrieved from http://floss.syr.edu.
4. Feller, J. and Fitzgerald, B. (2002) Understanding open source software development, Pearson Education, London.
5. Fershtman, C. and Gandal, N. (2004) *The determinants of output per contributor in open source projects: An empirical examination*, Working Paper (No. 4329), Center for Economic Policy Research, Retrieved from http://spirit.tau.ac.il/public/gandal/opensource_march1.pdf.
6. Franck, E. and Jungwirth, C. (2002) *Reconciling investors and donators: The governance structure of open source*, Working Paper (No. 8), Lehrstuhl fur Unternehmensfuhrung und -politik, Universitat Zurich, Retrieved from http://opensource.mit.edu/papers/jungwirth.pdf.
7. Gacek, C. and Arief, B. (2004) The many meanings of open source, *IEEE Software,* 21, 1, 34-40.
8. Hann, I.-H., Roberts, J., Slaughter, S. and Fielding, R. T. (2004) An empirical analysis of economic returns to open source participation, *Presented at the American Economic Association Annual Meeting*, January 2004, San Diego, CA, USA.
9. Hars, A. and Ou, S. (2002) Working for free? Motivations for participating in open-source projects, *International Journal of Electronic Commerce,* 6, 3, 25-40.

10. Hertel, G., Niedner, S. and Herrmann, S. (2003) Motivation of software developers in open source projects: An internet-based survey of contributors to the Linux kernel, *Research Policy,* 32, 7, 1159-1177.

11. Hofstede, G., Neuijen, B., Ohayv, D. D. and Sanders, G. (1990) Measuring organizational cultures: A qualitative and quantitative study across twenty cases, *Administrative Science Quarterly,* 35, 2, 286-316.

12. Lakhani, K. R. and von Hippel, E. (2003) How open source software works: "free" user-to-user assistance, *Research Policy,* 32, 6, 923-943.

13. Lerner, J. and Tirole, J. (2005) The economics of technology sharing: Open source and beyond, *Journal of Economic Perspectives,* 19, 2, 99-120.

14. Ljungberg, J. (2000) Open source movements as a model for organizing, *European Journal of Information Systems,* 9, 4, 208-216.

15. Madey, G., Freeh, V. and Tynan, R. (2004) Modeling the free/open source software community: A quantitative investigation. In S. Koch (Ed.), *Free/open source software development*, (pp. 203-220), Idea Publishing.

16. Markus, M. L., Manville, B. and Agres, C. E. (2000) What makes a virtual organization work?, *Sloan Management Review,* 42, 1, 13-26.

17. Mockus, A., Fielding, R. T. and Herbsleb, J. D. (2002) Two case studies of open source software development: Apache and Mozilla, *ACM Transactions on Software Engineering and Methodology,* 11, 3, 309-346.

18. Raymond, E. S. (1998) Homesteading the noo-shere, *First Monday,* 3, 10, Retrieved from http://www.firstmonday.org/issues/issue3_10/raymond/index.html.

19. von Hippel, E. and von Krogh, G. (2003) Open source software and the 'private-collective' innovation model: Issues for organization science, *Organization science,* 14, 2, 209-23.

20. West, J. and O'Mahony, S. (2005) Contrasting community building in sponsored and community founded open source projects, in *Proceedings of the 38th Hawaii International Conference on System Sciences,* 2005, Honolulu, HI, USA, The University of Hawaii, 196-206.