A Social Movement Approach to the Development and Diffusion of Open Source Technologies

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Abstract. Recent years, scholars have focused on the high performance and success of OS technologies in software industry. In theses researches, they have insisted on social and economic approaches to analyze the development and diffusion of OS technologies. These social and economic approaches to the OS phenomenon has given the great implications by identifying the collaboration practices in OS filed and economic value of openness in the technology innovation. But prior researches also have a limitation to clarify the conflicts in the goal and interest among the multiple OS related groups. This study has an aim to suggest a new political approach to analyze OS phenomena. Using the framework of social movement theory, this study provides the novel interpretation to the development and diffusion of OS technologies, not taking it as a collaborative behavior among the whole related actors, but seeing it as a confronting behavior among the different interest groups.

1 Introduction

Recent researches in technology and innovation management have focused on the high performance and success of open source (OS) technologies in software industry. They have repeatedly emphasized the importance of communitarian collaborations in the virtual development teams and the economic value of publicly accessible technologies as key factors for the successful development and diffusion of OS technologies. For examples, pioneering research by von Hippel and von Krogh (2003) has designated the economic value of volunteer's commitment and the succeeding collaborative participations as a core structure of OS development, and they have defined the OS development as a new-styled 'private-collective' innovation. Also, Baldwin and Clark (2006) have explained the architecture of participation to the OS developments; the modularity and option value of OS codes enhanced by the diffusion of OS software will mitigate the free riding in the OS development model.

In these regards, the prior studies on OS practices have highly focused on the two different dimensions of OS phenomenon. First, they have investigated the social

interactions among the participants in the specific OS projects, and identified its unique collaboration patterns without formal and central management for the technology development (Constant *et al.*, 1996; O'Mahony, 2003; Zeitlyn, 2003; Grewal *et al.*, 2006; David and Shapiro, 2008). Second, they have found the economic potentials of the OS technologies, and suggested the new style of economic behaviors using the free and open technologies supplied by multiple OS projects (Lerner and Tirole, 2002; 2005a; Dahlander and Wallin, 2006; Economides and Katsamakas, 2006; Fosfuri *et al.*, 2008).

Although these social and economic approaches have given the important implications on the advance of OS studies, they have also left the unfocused dimensions of OS phenomenon. Because prior studies with social perspective generally focused on the behaviors in the individual projects, there are so little arguments about the inter-project and inter-technology interactions in OS field. But many participants on the OS projects do not restricted on a single project but related with the development of multiple projects and technologies. And these inter-projects and inter-technology relationships could not be described as cooperation but also contradictions. Also prior studies with economic perspective have generally focused on the value of OS software and technologies. They have disregarded the non-exclusive characteristic of OS technologies, and the problems using these kinds of technologies for the proprietary economic behaviors.

In this study, my aim is to provide the novel interpretation to the development and diffusion of OS technologies, not taking it as a collective action among the whole related actors, but seeing it as a confronting behavior among the different interest groups. This new interpretation can provide the different viewpoint to analyze the development and diffusion of OS technologies, because it takes OS technologies not as free technologies but as the technologies that insist to be free, and it sees OS technologies not as individual market resources but as common resources that are protected by social movement in technology field. By using the social movement theory initiated by McCarthy and Zald (1987), this study describes the collective behaviors in OS field as a kind of social movement, and argues its success highly depends on the three conditions of social movement; resource mobilization, political opportunity structure, and framing.

This new perspective may bring the many unsolved questions, but the aim of this study is not providing the acceptable answers to theses complicated questions, but extending the new area of research on the OS phenomenon with the eyes of power and social change.

2 Social and Economic Approaches to the Open Source Phenomenon

In prior studies, researchers have insisted on the social and economic approaches to analyze the development and diffusion of OS technologies. With a social approach, they have explained the development of OS technologies as collaborative

commitments by communitarian participants and tried to reveal the social relationship among them (Constant *et al.*, 1996; O'Mahony, 2003; Zeitlyn, 2003; Grewal *et al.*, 2006; David and Shapiro, 2008). By doing so, they have successfully explained why developers commit their technological talents to the various OS projects without explicit economic rewards, and how this numerous projects can be implemented without formal structure and management.

Social scientists have recognized the economic role of social relationships for a long time. Because human being is not so much isolated to handle on the economic behaviors by himself, the economic behavior of social agent is embedded to his social structure, and enhanced or restricted by the relationship between social agents (Granovetter, 1985). Therefore, the economic behavior such as commitment of core development talents can be explained as a social recruitment and leadership between multiple social agents. In this regards, Grewal and colleges (2006) have analyzed the network structure of participating patterns under the multiple OS projects and designated the network embeddedness has significant effect on both technical and commercial success of OS developments. Kuk (2006) also argued that individual developers often interact strategically with other highly resourceful developers by forming a smaller but better organized structure to intensify the types of epistemic interactions that matter. Finally, Roberts and colleges (2006) emphasized the role of leaders of OSS projects who are trying to attract developers to participate in projects or to sustain their level of participation.

With an economic approach, researchers have revealed the economic value and potentials of the OS technologies, and suggested the economic use of OS technologies in the firms' technological innovation and entrepreneurs' business model (Lerner and Tirole, 2002; 2005a; Dahlander and Wallin, 2006; Economides and Katsamakas, 2006; Fosfuri *et al.*, 2008). By doing so, they have succeeded in reasoning the explosive diffusion of OS technologies and its impacts on the change of market competition and firm's innovation process.

After the argument about high transaction costs of market transactions with high asset specificities (Coase, 1937; Williamson, 1985), scholars in economics and business administration have generally regarded the firm's economic behaviors as internally organized processes to eliminate the economic inefficiency. Succeeding researches also suggested the continuous internal development of firm's specific resources and capabilities to sustain the economic growth and competitive advantage (Penrose, 1959; Wernerfelt, 1984; Peteraf, 1993). Comparing with this 'closeness' perspective on the economic behavior of firms, the performance of OS development has alerted the value of boundaryless collaboration to invite the core talents and idea from the external market and society. In this regards, Lerner and Tirole (2005b) have focused on the role of the code license to recruit the voluntary commitment without explicit rewards from the potential developer communities. Bonaccorsi and colleges (2006) have analyzed the strategies of software firms that have entered the open source field, and suggested to choose the hybrid model by combining the offering of proprietary and OS software under different licensing schemes.

3 Political Dimensions in Open Source Field

But there are still remained questions on the OS practices, which is not fully satisfied with the social and economic arguments by prior researches, and these under-explained questions are related with the core motivation of open source activities and its impacts on our economic society. First, prior researches have generally disregarded the political dimension of OS practices, which is the primary concern of OSI (Open Source Initiatives) who provided the driving force to the success of OS technologies (Raymond, 1999; Stallman, 1999). It means that there are some shortcomings in reasoning why the free and open technologies like OS exist or how can it be remained as free and open.

In the short history of OS, one can easily find the political intentions as core driving force to initialize the practices of open source development. The well-known documents, 'The cathedral and the bazaar' presented by Eric Raymond at the O'Reilly Perl conference, September 1997, has called the global attentions to protect the freedom of technologies from the proprietary monopolistic intention. This suggestive idea has gain the support by the releasing of source code of Netscape at January 1998, and realized as labeling, 'Open Source', at the strategy session in Palo Alto, California February 1998, and resulted in the founding of the open source initiatives (OSI) and open source definition. Over the next two month, most of the tribal chieftain of the hacker culture have met at the O'Reilly's Software summit, and agreed the adoption of this rhetoric, including Linux, sendmail, Perl, Python, Apache, and many other free-software projects. Therefore OS practices can be described as a collaborative development process in the boundary of OS field, but also can be discriminated as a contradiction and resistance against the outside of the field.

Second, prior researches have generally analyzed the OS phenomenon as a behavior of individual developers, projects, or organizations: such as participation, commitment, communication, utilization, or commercialization. But there are few arguments about the effects of environmental conditions on the OS phenomenon, such as market structure of IT industry, governmental policies or legal institutions (Lerner and Tirole, 2005b; Yi and Noda, 2010). Also they have ignored to analyze the interactions among the multiple OS groups; such as inter-project or inter-foundation collaboration, collective action of OS institutions, or interdependence with OS technologies and proprietary technologies, which can give the deeper and valuable understanding about the dynamics in OS field.

OS has taken an advantage in its style of development 'openness,' therefore this open boundary is not limited to the internal collaboration within individual projects, also can be extended to invite the external inter-relationships between multiple open and proprietary projects. Sometimes, these inter-related processes can cause the significant interest conflicts among the multiple economic agents. For examples, we know that there are many license disputes between OS developers and economic entrepreneurs for the use of intellectual property related with OS technologies, and there was the well-known conflict between Apache foundation and AOL for the

direction of web technology standard, which resulted in the political sanctioning and succeeding revenges. Even inside the OS communities, there are unfinished problems using multiple open licenses because they have different restrictions on the duty of openness, and the dichotomous debates between OS developers was induced to revise the most popularly used GNU public license (GPL) for tightening its restriction against the commercial uses. These cases suggest to investigate the inter-dependence between multiple economic agents who related with OS technologies but with different interests. The <figure. 1> summarizes the inter-relationships among the multiple agents in OS field to help identifying the structure of potential conflicts and collaborations.

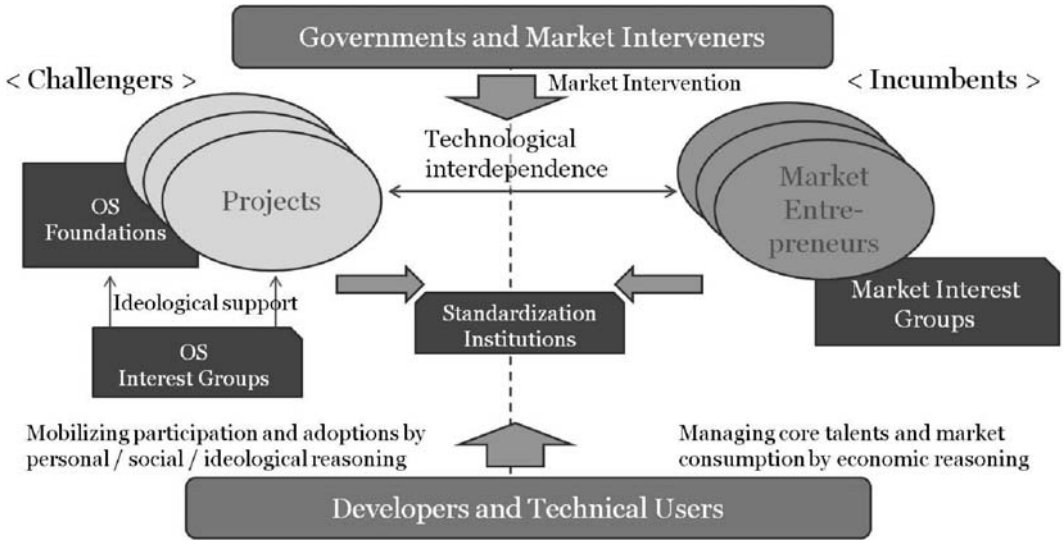

Fig. 1. inter-relationship between multiple agents in OS field

4 Open Source Phenomenon in the Eye of Social Movement Theory

In this study, I propose the new political approach to analyze the development and diffusion of OS technologies. By focusing on the political dimensions of OS practices, this study aims to provide the novel interpretation on the activities in the OS field as a open source movement (Lerner and Tirole, 2001), which can be seen as collective action of IT developers to protect the publicity of knowledge and the initiative in technological innovations, in opposition to the power of proprietary practices in IT industry.

My theorizing on the OS movement is highly depended on the social movement theory initiated by Zald and McCarthy (1987), and extends their theoretical

framework used to analyze the social movement into the explanation for the development and diffusion of OS technologies. During the period of social change, the collective agents who are involved in the political dynamics can be assumed to take one of the two roles in the agency structure: incumbents or challengers (Gamson, 1975; Tilly, 1978; Zald and McCarthy, 1987). Incumbents are those who have vested interests in and thus pursue the maintenance of an existing social model. Hence, incumbents resist external pressures for social and institutional. In contrast, challengers are committed to changing the existing social model, and thus they promote social and institutional change (Tilly, 1975; Zald and McCarthy, 1987).

Given the existence of disagreements between incumbents and challengers in a social change, the economic and social agent choices to preserve or discard an existing social and institutional model are likely to be determined largely by the degree of power held by incumbents and challengers (Kim et al., 2007). That is, the likelihood that an agent will replace a previously institutionalized practice with a new alternative is associated with the vulnerability to change the power structure of its agents: weaker power of the incumbents and stronger power of the challengers at the stage of social change. In addition, the effectiveness of the tactics that social incumbents employ in the process of pursuing their preferences also significantly affects each agent's choice of preserving or discarding a previously institutionalized practice (Tilly, 1978; Oberschall, 1979; McAdam, 1982; Gamson, 1991).

The tactics and conditions that social incumbents employ in the process of social movement can be generally summarized into the three conditions: resource mobilization, political opportunity structure, and framing (McCarthy and Zald, 1987; Gamson and Meyer, 1996). These tactics for the social movement can be also found in the activities of OS movement, and it gives a useful way to the OS researchers for finding the political dimensions in OS phenomenon.

Resource mobilization is key factor for the success of social movement result in the social change and institutionalization of new practices. At this point, the success of development and diffusion of OS technologies highly depend on the successful mobilization of key resources: technological talents of developers and the adoption of OS technologies by various economic agents. It means that the success of OS technologies can be also asked at the viewpoint of projects; such as what is the main strategies and tactics used by OS projects to mobilize the talents of developers, what kind of projects can be survived at the competition among the multiple projects? These questions can provide the different implications on the OS phenomenon, which could not be suggested by the prior researches that are only focused on the interests of participants and economic users. In this respect, Shin and Yi (2006) have suggested the main characteristics of OS technologies, which are successful in the mobilization of developer's commitment: resource popularity, resource co-attachment, and resource standardization.

Political opportunity structure means a set of formal and informal political conditions and contexts not only encourages or discourages social movements but also affects their strategies, structures, and outcomes. A political opportunity structure often triggers social movements by increasing incentives and lowering costs as well as

constrains them by restricting available options (Tilly, 1978; McAdam, McCarthy, and Zald, 1996).

At the field of OS, political opportunity structure is highly related with the strategic utilization of OS technologies by governmental and private sectors for the expenditure-reductions and innovations. But it seems to be little concern about the contradictions between OS technologies and proprietary ones. OS movement has an aim for the replacement of proprietary technologies with OS technologies, getting rid of private rents from the exclusive ownership of technological knowledge. Therefore, the impact of success and diffusion of OS technologies is not restricted in the technological field. It will initiate various social and legal issues for the exclusive ownership of technological knowledge, such as licensing compute, technological standardization, and anti-trust law.

Lastly, Framing has recently received increasing attention in various social science literatures, such as cognitively psychology, sociology, political science, and communication studies (Tversky & Kahneman, 1981; Morris & Mueller, 1992; Steinberg, 1998). According to the framing literature, an actor is viewed not as a passive carrier or transmitter of existing meanings, but as a signifying agent who is actively engaged in the production and mobilization of meanings and ideas for constituencies (Benford & Snow, 2000). That is, a frame provides an actor with a cognitive clue for efficient sense making as a type of package by clarifying ambiguous causality, distinguishing between desirable and undesirable behaviors, and cognitively supporting appropriate behaviors (Steinberg, 1998; Benford & Snow, 2000). And framing is often employed by the organizer of a social movement as a strategy to mobilize potential constituencies (McAdam, 1996). In this respect, Gamson and Meyer (1996) suggest that framing is an efficient mobilizing tactic especially for underprivileged groups to acquire legitimacy. Also, Pellow (1999) argued that environmentalists' innovative tactic of issue framing has contributed significantly to the success of environmental movements.

The framing of OS movement can be easily found at the slogans used by the OS initiators, such as 'free as in freedom' by FSF, 'shot round the world' by OSI, and 'Cathedral and Bazaar' by Eric Raymond. These metaphors can clarify the meaning of OS movement, and intuitively classify the agents' behaviors into the two divided side: the OS world and proprietary world. Indeed, the framing by OS movement can enhance the collaboration between numerous OS projects and groups implicitly and explicitly, and sometimes it disclosed the potential collusions between OS agents who have the different aims and values on the future path of OS technologies

5 Conclusion and Discussions

This study shift the question about the OS phenomenon from the participation on the view of developers into the mobilization on the view of social movement incumbents, and also bring the concern to the utilization of OS technologies for the confronting to

the proprietary technologies, not for commercializing for the proprietary market. Indeed, this study suggests the new direction of researches about the collective action of OS development and diffusion on the level of inter-project and technology, not on the level of intra-project and technology.

In conclusion, this new approaches does not provide the immediate explanation to solve the behaviors in OS world. Alternatively, this study suggests the various unquestioned questions for the unrevealed core of OS phenomenon. As like the OS technology has advanced with the collective commitments from the private initiation, this initiated approach can be testified and sophisticated by the following academic commitments.

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