Development Style of Open Source Software and Innovation of Business Enterprises

Tetsuo Noda [1+], Terutaka Tansho [1] and Cai Liming [1]

[1] Shimane University, Japan

Abstract. This study summarizes the current research trends and economic theories behind the motivation factors of open source software developers. It has been said that the development style of open source software is supported by the volunteer engineers' gift economy. But the expansion of the application of open source, and thereat the expansion of market, business enterprises have become engaged in open source, not only use of it but also participating the development of it. From the viewpoint of these enterprises, they have to reduce the cost rise by competitive pressure, somehow brought by open source, and participate in the development process to share development cost. But, this process does not make the market competition disappear. It is expected that the leadership struggle in the development process will become more serious. It may be the fourth stage of the open source business model.

Keywords: open source, motivation, open innovation, software development

1. Introduction

The development style of open source software is a process in which software code is developed on the Internet-based open network with the participation of a number of developers, software engineers and also business enterprises. The developed software including the source code is released to the public, and can be freely modified, improved and re-distributed. Originally open source software was developed in this kind of community-based participation style without being directly linked with business. However, a new phenomenon can be seen in which the development of open source software is embedded in the productive process of private business enterprises. These enterprises attempt to maintain the motivation on the part of software engineers in the open source community, and then absorb the outcome of their effort and labour over the border of business enterprises. This study firstly summarizes the current research trends and economic theories behind the motivation factors of open source software developers. Secondly, we try lateral approach from the innovation factor of business enterprises.

2. Research Trend in Motivation of Open Source Software Development

2.1. Open Source Software Development and Community "Organization"

With regard to the development style of open source software, Raymond (1999) advocates the "Bazaar" development style – a number of engineers, researchers, and business enterprises participate voluntarily in the development over the border of enterprises and organizations. The "organization" which incorporates these open source software engineers is often called "Community". Raymond applies "bazaar" as a metaphor for the market on one side, however, from another angle, it can be said that the community is an "organization" consisting of software engineers and developers connected via the Internet.

From this organizational perspective, von Hippel (2002) insists that the participation in the open source development is completely "competitive" and that the Community is fully open not only for the corporate suppliers but also for software users. On the other hand, Garcia & Steinmueller (2003) criticize the "horizontal organization" referred to by von Hippel, and analyze the hierarchical organization in open source software development by dividing core committers to the users as a form of "division of labour". Berdou (2007, 2011) applies this organizational structure as a preface, and then clarifies the features of the organization – all the parties of core committers as well as users and volunteers, maintaining motivations by themselves, form an organization and are integrated into the Community.

[+] Corresponding author. Tel.: + 81-852-6164; fax: +81-852-6164.
  E-mail address: nodat@soc.shimane-u.ac.jp

2.2.   Development Motivation and "Gift" Concept

On the motivation of developers participating in the Community – the organization with hierarchical structure, Raymond (1999) refers to the concept of "gift".

Zeitlyn (2003), on the other hand, claims that the open source development community should not be treated figuratively in the context of neoclassical market economy. According to Zeitlyn's view, the open source development community is physically dependent on the Internet-based public domain, however, can be regarded as a society in which "gift" exchanges exist as an important principle over the economic domain, likewise the primitive society in the ancient era. In this society, when someone provides something, and another receives; there is an enforcement of action "give back". From these viewpoints, the open source development community is the small world where the gift economy is established.

In contrast to the gift concept where the provision of developed code is considered as a gift to the community, Weber (2000) claims that software development is dependent on the human capability where the principle of resource scarcity is applicable, criticizing the gift concept that this view is based on the increasing returns by improvement and enhancement of information processing technologies such as internet bandwidth and hardware disc advancement. Weber also asserts that the developers' motivation is influenced by self-display of scarce capability and ones' "artistry". Weber's standpoint is also common in what is based on the gift economy.

2.3.   Cost-Benefit Analysis of Development Motivation

In contrast to the gift concept, Lerner & Tirole (2000) illustrate the development motivation that there exists a "tacit contract" – by taking part in the open source development, in such a way that such merits as future job opportunities, establishment of a start-up company (business-based open source development), procurement of start-up entrepreneur benefit by IPO, can be secured. Lerner & Tirole criticize the gift concept by insisting that "engaging in an open source development project is beneficial to the developers and profitable in business environment". Based upon this assumption, Lerner & Tirole (2002) conduct qualitative surveys regarding the open source developers' motivation and future careers in the open source development project such as Apache, Perl, Linux, and Sendmail. Lerner & Tirole describe the fact that these programmers (developers) are successful in business in their future careers. Consequently, Lerner & Tirole conclude that there exists a "tacit contract" through which the developers can gain future benefit – future job opportunities, open source related business start-up, and acquisition of start-up entrepreneur benefit by IPO, and that these assumed benefits can become the accompanying motivation behind early development work.

In addition, Lakhani and von Hippel (2003) analyze the behaviour of Apache developers in response to the inquiries from users. They describe that the developers may lose their exclusive value (software knowledge) by responding to inquiries, however, they may also acquire a reputation by providing knowledgeable advice in the Internet website as a public space. Lekhani & von Hippel conclude that there is a tendency that developers take this action for acquiring reputation as a strategic opportunity for themselves.

2.4.   From "Gift" to "Cost-Benefit"

As we have discussed in previous sections, the primary motivation factors of open source software developers can certainly be explained as "gift" or "intellectual interest". On the other hand, we are in the supportive position that the cost-benefit features of open source development motivation will be enhanced with the expansion of open source software utilization in the enterprise fields, independent of the open source developers' motivation.

From the viewpoint of the enterprises intending to introduce open source software, the greatest reason is often cost reduction. The cost-reduction of these enterprises (or governmental organizations) may lead to the shrinking of the market in information service industries; therefore it is necessary for these IT industries to cultivate new market to maintain and expand their business. In this competitive market of cost-reduction and necessity of new business development, the IT industries and suppliers need to incorporate outside resources into enterprise fields. These are the software development outcomes by open source software developers which inevitably create a "gift economy" embedded into the "exchange economy". The open source software has been developed in the forms such as "participation", "gift" and "artistry", not directly linked with

business behaviour. However, now that open source software development is incorporated into the production process of private enterprises, it is required to maintain the motivation of open source development community and also to contribute to the cost reduction in the business fields.

According to the above-mentioned study by Lekhani & von Hippel (2003) on the time contribution of open source software developers, developers recruited by private enterprises provide "more than 2 working-day time expenses a week", and the volunteer contributors spend "more than 1 working-day time expense a week" in free and open source development projects.

As has been explained about the research trend in the U.S. and Europe, the motivation of developers will make a shift from "gift" to "cost-benefit", or the degree of primary objectives will be shifted gradually from "gift" to "cost-benefit" along with incorporation of open source into the business fields.

3. Open Innovation and Open Source Software Development

3.1. Open Source Software Development and Problem of Free Ride

Increasing "cost-benefit" motivation of developers means, conversely, strengthening involvement of business enterprises in the development of open source software. The reason why business enterprises become engaged in the development is obviously to absorb the outcome of developers' effort and labour over the border of business enterprises. So, the "motivation" factor of business enterprises must be analysed in a different perspective.

Seen from another standpoint, if we assume the rational individuals (or rational business enterprises) who attain convenience maximization in "cost-benefit" motivation, as is indicated in Adar & Huberman (2000), it is thought that the free ride on the outcome of open source software development. If every individual (or every business enterprise) behaves rationally, provision of open source software will come down, and finally run dry. Previously Ghosh (1998) explains this by "Cooking-pot Market" model, the inexhaustible of resources by the easiness of duplicating data treasures. To be sure, owing to the rapid progress of information and communications technology, the cost of duplicating has become vanishingly small. However, the resources of open source developers, human labour, are not inexhaustible. Rather, these developers are rare technical elites. So, business enterprises that want to absorb the outcome of open source must take part in open source development processes and as contribute to them as these developers. This is nothing else the process of "Open Innovation".

3.2. From "Motivation" to "Innovation"

Chesbrough (2003) describes traditional separate style business strategy as "Closed Innovation", in which enterprises develop ideas, marketing, support, and financing by themselves. And, researches and developments of course are performed intra-enterprises. But the superiority of "Closed Innovation" is coming down because of liquidation of labour, improvement of knowledge power of employee, and the existence of venture capitals. Thus business enterprises have become to use inflow and outflow of knowledge to fit their purposes, not only accelerate their internal innovation, but encourage the innovation to be used externally. This process is "Open Innovation". This process blurs boundaries between business enterprises, and by joining internal resources and external resources together, extra values are formed.

This development style is exactly the same as open source development style. As mentioned above, open source is being developed by "Community", whether it is Bazaar style or hierarchical, the organization is opened for every developers, software engineers and business enterprises, and they can participate or withdraw all along the line, if only they possess knowledge of open source and it's codes. Therefore, from the viewpoint of business enterprises, they participate in open source development, "Community", beyond the confines of organizations in order to absorb the fruits of innovation which were developed through engineer's motivation. However, to bring this to fruition, they need to participate in "Community".

3.3. Three-Stage Approach of Open Source Development

Kunai (2010) categorizes open source business model into the "Three-step Model" from the involvement of business enterprises. As moving up the ladder, though the cost of the development increases, business enterprises can increase the economic effects as shown in Fig. 1.
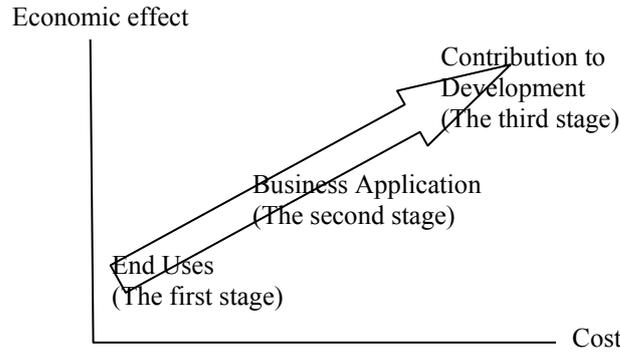
Fig. 1: Three-step Business Model of Open Source

In the first stage, business enterprises use open source as end users, and they only use open source with the same uses of proprietary software. Their primary purpose is cost reduction, but economic effect is very low. In the second stage they use open source for their businesses, expanding functional features they need, and construct application software, serve support for their customers, and integrate systems. In this stage, economic effect is comparatively higher than that of the first stage, though cost rises because of the demand of manpower and equipment to construct these derivative businesses.

And, in the third stage they participate in the development process of open source, and bring forth the highest economic effect. They contribute "Community" by providing physical support and financial backing. The development style of this stage different from the rest is that they (business enterprises) develop software in association with each other, participating in "Community". Of course in this "Community" there are many resourceful software engineers, who have "cost-benefit" motivation as has been previously described, and they also contribute to the development process of open source by fixing bugs or supplying patches. In this way business enterprises become to be able to reduce the cost of the demand of manpower and equipment. Thus the process of "Open Innovation" enable business enterprises to absorb the fruits of the "Motivation" of open source engineers.

3.4. "Cost-Benefit" Approach of "Open Innovation"

The purpose of business enterprises can be described by the development cost structure, based on Chesbrough (2006).
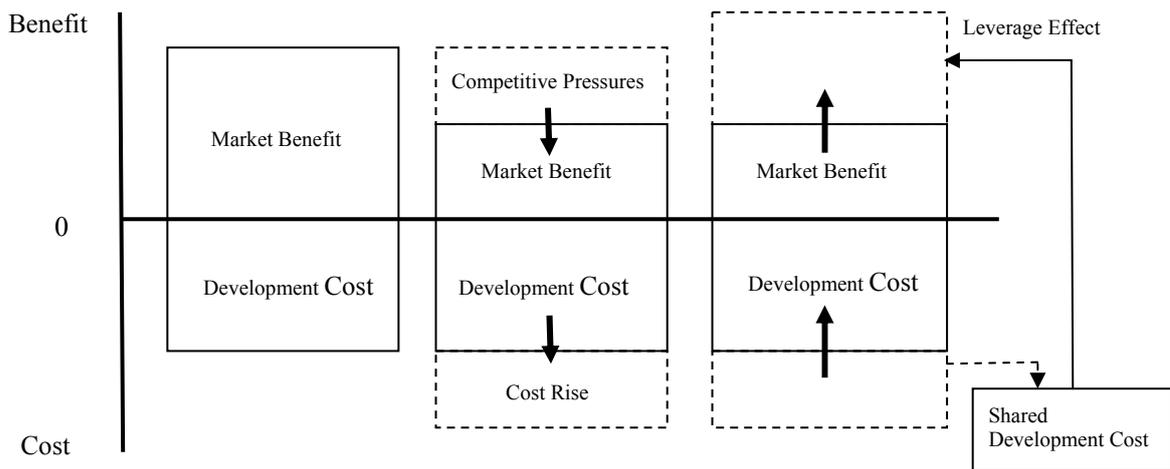

Fig. 2: Development Cost Structure

In the development style of open source, as is described to the right side of Fig. 2, business enterprises can reduce the development cost by sharing and turn over it to the contribution to the development of open source community. This process can produce not only the development of open source technology but also that of business applications they provide to the market. Thus they can gain the increase of market benefit produced by leverage effect.

4. Conclusion

It has been said that the development style of open source software is supported by the volunteer engineers' gift economy. But, the expansion of the application of open source, and thereat the expansion of market, business enterprises have become engaged in open source, not only use of it but also participating the development of it. From the viewpoint of these enterprises, they have to reduce the cost rise by competitive pressure, somehow brought by open source, and participate in the development process to share development cost. But, this process does not make the market competition disappear. It is expected that the leadership struggle in the development process will become more serious. It may be the fourth stage of the open source business model.

5. References

[1] E. Adar and B. Huberman, *Free Riding on Gnutella,* First Monday,Vol.5,No.10. 2000.

[2] E. Berdou, *Managing the bazaar: Commercialization and peripheral participation in mature, community-led F/OS software projects*, Doctoral Dissertation. London School of Economics and Political Science, Department of Media and Communications. 2007.

[3] E. Berdou, *Organization in Open Source Communities: at the Crossroads of the Gift and Market Economies*, Routledge,.2010.

[4] H. Chesbrough, *Open Innovation: The New Imperative for Creating And Profiting from Technology*, Harvard Business School Press. 2003.

[5] H. Chesbrough, *Open Business Models: How To Thrive In The New Innovation Landscape*, Harvard Business School Press. 2006.

[6] H. Chesbrough, V. Wim, and J. West, *Open Innovation: Researching a New Paradigm*, Oxford University Press. 2008.

[7] J.M. Garcia and W.E. Steinmueller*, The Open Source Way of Working: A New Paradigm for the Division of Labour in Software Development?* , SPRU – Science and Technology Policy Research University of Sussex INK Research Working Paper No. 1 January 2003.

[8] R. A. Ghosh, Cooking-pot Markets: *an economic model for the trade in free goods and service on the internet*, First Monday, Vol.3, isuue.3. 1998.

[9] K. Lakhani and E. v. Hippel, *How open source software works: "free" user-to-user assistance*, MIT Sloan School of Management Research Policy 32. 2003.

[10] J. Lerner,J and J. Tirole, *The Simple Economics of Open Source*, NBER, February 25, 2000.

[11] J. Lerner,J and J. Tirole, *Some Simple Economics of Open Source*, Journal of Industrial Economics 50. 2002.

[12] S. E. Raymond, Homesteading the Noosphere, *The Cathedral and the Bazaar: Musing on Linux and Open Source by an Accidental Revolutionary*. Sebastopol Calf. : O'Reilly & Associates. 1999.

[13] E. v. Hippel, *Open source projects as user innovation networks*, MIT Sloan School of Management Working Paper 4366-02, June. 2002.

[14] S. Weber, *The Political Economy of Open Source*, Working Paper Series 1011, UCAIS Berkeley Roundtable on the International Economy, UC Berkeley. 2000.

[15] D. Zeitlyn,D, *Gift economies in the development of open source software: anthropological reflections*, MIT Sloan School of Management Research Policy 32. 2003.

[16] T. Kunai, Three-stage approach of Linux Development, *Let's go by Linux* vol.2. 2010.