

Open Source Software Movement: a Challenging Opportunity for the Development of China's Software Industry

LI Ming-zhi, ZHENG Jie

(School of Economics and Management, Tsinghua University Beijing 100084 China)

Abstract *The software industries in developing countries are facing enormous challenges in order to grow amid fierce competition of import from the software makers in developed countries. Open Source Software (OSS) movement, which is a particular phenomenon in the software industries, seems to be a challenging opportunity for the developing countries that wants to move their own software industries up the value chain. This paper, using China as an example, identifies the issues that need to be addressed for the software industry, as well as the special characteristics of software products that need to be dealt with carefully. It proposes promoting OSS as a strategy the Chinese government should adopt to grow the software industry and the specific actions that should be taken.*

Key words *China's software industry; open source software(OSS); public good; value transfer; development strategy*

1 Chinese Government's Important Actions Regarding OSS

In recent years, the rising and thriving of OSS movement has become an interesting phenomenon in the software industry worldwide, which attracts the attentions of academia and practitioners. In addition to the private individuals who devote themselves to the development of OSS and the commercial companies which benefit from such movement, the Chinese government has also played an important role in the process of promoting the OSS movement in China.

The most significant step among the actions which the Chinese government has taken in order to promote OSS was the first China-Japan-S.Korea IT ministers' conference for OSS held in Beijing on April 3, 2004. The three countries signed "the Memo for Cooperation on Opening Source Code", which indicates that they have reached basic agreement on the formation of a joint open-source software project that could encompass desktop applications, embedded programs, middleware and operating systems.

It is obvious that behind the collaboration among the three countries is a wish to develop their own

software industries and break the dominance of western software companies in the operating system and applications market. So far most high-end software products have been developed by the U.S. and European companies, which means developing nations like China and South Korea are in a disadvantageous condition in the market. They want to use OSS as an opportunity to move up the value chain in the software market.

But whether China can fully take advantage of this challenging opportunity to develop its domestic software industry still remains to be seen. And the strategies for the promotion of such a policy also need careful calibration.

2 The Economic Characteristics of OSS

Generally speaking, OSS is technically defined as a kind of software whose executable program is distributed with the source code, often under a license that sets conditions for modification, reuse and re-distribution of the software. While from the economics point of view, we will find that beyond the

technical definition of OSS it is a public good whose value could be fully transferred.

2.1 The Property of Public Good

The software industry has two main significant properties. First, the software industry is experiencing huge economies of scale in that the development of the software requires a large amount of investment, and the cost of producing each additional copy will be almost zero^[1]. Second, the network effect, which means that the benefit one consumer derives from using a product increases with the number of other consumers of the same product, is pervasive in the software industry.

Combined with the general properties of the software market, the unique characteristics of the OSS would contribute to its features of public good. As is defined by economists, a public good is a resource that is both non-rivalrous and non-excludable. It is non-rivalrous if one person's consumption of the resource does not reduce the amount available to others. It is non-excludable if there is no feasible way to block somebody from consuming the resource.

On one hand, thanks to the economies of scale in production and the emergence of powerful networks, software can be copied and distributed at almost no cost. Thus the ordinary software fulfills the feature of non-rivalrous to some extent. One the other hand, due to the prevalent phenomenon of piracy software, so far in China the exclusion of people to use the proprietary software freely seems very hard. The pervasive illegal

distributions for licensed software are due to the non-excludable property of software to some extent.

Furthermore, for the OSS, the fact that the information about how a program works – how it achieves its functionality – is contained within its source code contributes to its non-rivalrous feature. One's consumption of that knowledge would leave as much for others as before. At the same time, it would be hard to exclude one's knowledge of it to the extent that knowledge is known generally^[3].

The major concern with a public good must be the free rider problem. The non-excludable nature implies there is not enough incentive for the users to contribute to the provision of public good. Thankfully, OSS is a special public good in that it is free of the most challenging issue in public good provision. Rather than the free rider problem of a typical public good, OSS has many enthusiastic free contributors^[2]. According to Lessig^[3], the OSS movements are completely consistent with a tradition of innovation and development outside the context of software.

2.2 The Achievement of Full Value Transfer

As a product of knowledge, the software's constitution of value differs from ordinary products. the value of a kind of software (V) is composed by its value of application (V_a) and its value of further exploit (V_{fe}), as showed below.

$$V=V_a+V_{fe}$$

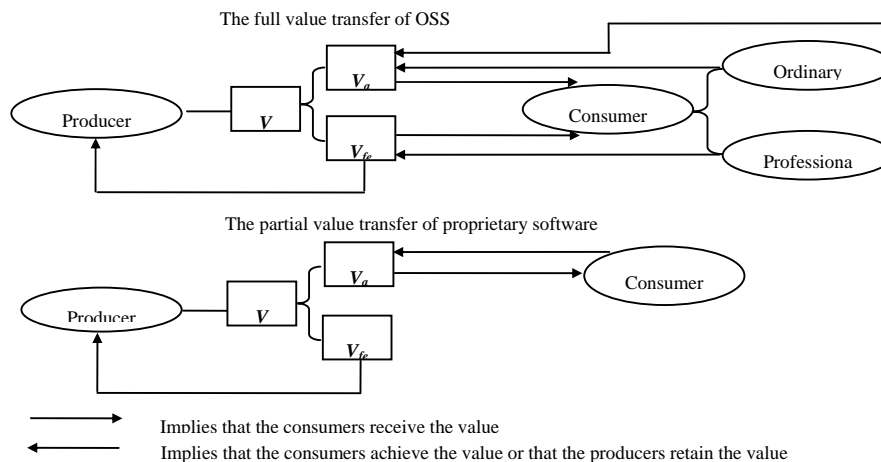


Fig.1 Comparison of OSS and proprietary software in the process of value transfer

As for proprietary software, the value transfer from the producers to the users is partial, since the right to further exploit the software is retained by the producers. While for OSS the situation is different. With the source code available free and the right to modification, reuse and re-distribution of the software, not only can the users receive its value of application, but the professional users can also modify or enhance the software for themselves. Fig.1 describes the process of value transfer of the two kinds of software.

The characteristics of full value transfer which gives users access to the working mechanism of the software and permits modification, reuse and re-distribution of the software, makes OSS appealing to the Chinese government that wants to break the dominance of western software companies in the operating system and applications market, helping domestic software industry growth.

Contrast to the proprietary software, the intrinsic

advantage that OSS is a public good whose value could be fully transferred, serves one reason why the Chinese government takes efforts to promote the development of OSS in China.

3 The Software Industry in China

Another reason for the Chinese government's preference to OSS should be regarded with the current status of the software industry in China. In recent two decades, China's high-tech industry has experienced rapid development at a faster pace than the whole economy, in which the software industry is contributing increasingly more weight. In the past 10 years China's software industry revenue has been growing at an annual rate between 20-40%. Tab.1 shows that China has a huge domestic market for the three diversified software products.. In 2002, China's application software accounted for 64.5% of the total domestic software products.

Tab.1 The structure of software products in China (from 1992 to 2001)

Year	The system software		The maintenance software		The application software	
	Revenue RMB10million	Proportion	Revenue RMB10million	Proportion	Revenue RMB10million	Proportion
1992	1.6	8%	5.4	27%	12.8	65%
1993	3.6	9%	10.8	27%	25.6	64%
1994	4.5	9%	13.2	27%	31.3	64%
1995	6.5	10%	15.0	22%	46.5	68%
1996	8.5	9%	20.0	22%	63.5	67%
1997	13.7	12%	27.5	25%	70.8	63%
1998	17.4	13%	35.9	26%	84.7	61%
1999	21.0	12%	44.8	25%	110.2	63%
2000	33.2	14%	49.6	21%	155.0	65%
2001	50.0	15%	81.9	25%	198.1	60%

Although China's software industry has achieved a great success, there are still some major problems, which are becoming the obstacles in the path of China's software industry development. We will analyze these problems which may account for the Chinese government's promoting action on OSS movement in three different levels: the industry level, the producer level, and the consumer level.

3.1 Industry Level

3.1.1 Analysis of Status

Belying the rapid growth, small scale and low technology level tell the truth of China's software industry today. According to *the Bulletin of China Software Industry Association (2001)*, the total revenue of software in China only accounts for 1.5 percent of the world's total revenue of software in 2001. Furthermore, China's software industry lacks senior professionals in core technology for the software. In 2002, of 59 000 software personnel, 7% had Master degrees, 33% had Bachelor degree, and 17% had

polytechnic degrees, and there were only 157 000 research and development professionals scattered among 4 700 companies. On one hand, these facts implies, in order to develop the software industry, China needs a way that can benefit more from the fruits of current achievements. Fortunately, OSS movement fits the condition. On the other hand, it also tells the possibility that China can evolve its software industry with OSS more easily than those which have already developed their software industry on a much higher level.

3.1.2 Analysis of Structure

The software market can be subdivided into two: the upstream operating system sector and the downstream application software sector. In the upstream operating system field, Microsoft's monopoly power is hard to break because of its dominant market share and the network effect. So far, Chinese upstream software providers have limited ability to provide better products to compete with Microsoft. With the better platforms supported by upstream OSS software as a public good backed by the government, more investments will be attracted in the development of downstream application products and services. Any investment in R&D from a company may also benefit its OSS competitor. The adoption of OSS in upstream software market will also change the competitive landscape of the whole software. In the Linux vs. Windows case, by breaking up the dominance of Microsoft in the upstream OS segment, the vertical externalities between Linux and the Linux-based applications will mutually reinforce each other and finally change the equilibrium of the competition in the software market.

3.2 Producer Level

The size of software firms matters in the market because a firm's economic scale predetermines its ability to compete and to survive. According to the MII and NBS of China, the sizes of China's software companies are still relatively small. In 2002, two thirds of Chinese software companies had the number of employees not exceeding 50. About 26% of the companies had employees between 50-300. The revenues of 95.5% Chinese software companies are

less than US\$12 million (RMB 100 million) in 2002. Such a small size of software firms partly accounts for the low competency of Chinese software companies in the world, which has become the bottleneck of China's software industry development. With the public good property and the achievement of full value transfer, the production of OSS can make firms benefit from others and thus cooperate on a higher level to contribute to the rapid growth of China's software industry.

3.3 Consumer Level

From the consumption prospect, the major problem is that the massive software piracy is not well under control in China at present. The Business Software Alliance estimates that pirated software account for 92% of the Chinese software market—the second highest piracy rate among the 86 countries it tracks. The same study values lost revenue due to piracy in China at \$2.4 billion. While the amount of the loss may be over-estimated considering most piracy copy buyers would not have spent much more to own an authentic program, it definitely hurts incentives for software firms to innovate and market their software products in China. According to a survey conducted by People's Daily in 2001, more than a quarter of Chinese software firms believe software piracy is the most important barrier to their development, and about one fifth of the companies complained that software piracy has seriously constrained further R&D investments into software products^[4]. Since OSS is not only a public good without free rider problems, but also a piracy-free alternative to proprietary software, it seems to be the best choice for Chinese government to develop its software industry efficiently and effectively.

4 The Chinese government's Strategy in Promoting OSS

4.1 The Necessity and Possibility of Government Intervention

Due to the features of economics of scale and network effects, the existence of monopoly power is pervasive in the software industry, especially in the field of operating system, where software windows

series dominate the whole market. The market failure out of the monopoly power offers one reason why government should intervene in the development of the software industry. Another market failure due to the issue of proprietary software piracy also needs the government to take certain measures. Thankfully, as discussed above, the promotion of OSS could probably solve these two problems: the introduction of OSS into the software market can promote competition and the stable incentives of the enthusiastic free contributors make free riders no longer a problem.

4.2 Suggestions to Chinese Government's Policies to the OSS Movement

Based on these analyses, we propose some concrete steps the government can take for the

long-term development of its software sector. Among all the policy levers the government can utilize, we believe the following are critical for the success of OSS in China:

4.2.1 Subsidizing Investment on the Software Sector and the R&D Activity in OSS in Particular

Software has been the weakest sector in China's Information and Communications industry. Among all the reasons, the relatively favorable investment policy towards hardware could be an important factor (see Tab.2). To promote the development of OSS, the government needs to take more active measures such as direct investment in the basic R&D, tax breaks for software firms engaging in OSS related R&D programs, etc.

Tab.2 Investment in ICT

100 million Yuan	Telecom	Electronic and communication equipment manufacturing	Information consultation	Computer service
1993	218.82	47.49	0.14	0.16
1994	409.04	47.39	0.17	0.09
1995	491.94	65.84	0.60	0.12
1996	594.09	67.34	0.22	0.14
1997	343.56	122.40	2.27	0.80
1998	477.86	178.05	3.72	2.09
1999	469.42	146.01	3.36	8.22
2000	679.04	214.80	3.36	25.44
2001	769.93	298.57	13.30	34.86

Data source: China Statistic Yearbook

4.2.2 Adopting OSS in the Public Sector

More and more nations have shown their support for the adoption of OSS products and services in the public sector. For example, Hahn^[5] reported that France passed a parliamentary bill requiring government-related institutions to use only OSS; Italy also has a bill that mandates preference on OSS in all governmental offices. In the case of China, this will be an extremely powerful lever considering the huge government procurement of software in the massive projects such as e-governments. By endorsing the OSS product and service, the private sectors will also be more prone to choose OSS due to the consideration of compatibility and maybe even due to the belief that OSS is becoming a fashion.

4.2.3 Promoting Education and Training in OSS: Fostering the Alumni Effect

Software is a knowledge intensive product. Introducing OSS curriculum into universities will create a huge number of computer software professionals proficient in OSS from their early ages. Companies such as Microsoft and Apple have been giving or discounting their product to the students for years for the exact same reason. OSS has an advantage over proprietary products to begin with, thanks to their cooperative nature. The culture of openness and altruism embedded in the OSS movement will also shape the young talents' work ethics and attitude. By injecting OSS into curricula, the government acts as a promoter to the already popular amateur OSS

development. After they graduate and join the work force, the alumni effect and network effect will make the trend of OSS irreversible.

4.2.4 Fostering Institutions that Coordinate OSS Movement

According to Porter^[6], institutions for collaborations (IFCs) will play a more and more important role for competitiveness: industry associations, professional associations, technology associations, non-profit think tanks, etc. Considered another asset of the Indian software industry, the Indian National Association of Software and Service Companies (NASSCOM, see <http://www.nasscom.org>) has played a critical role. In comparison, NASSCOM's counterpart in China, the China Software Industry Association (CSIA, see <http://www.csia.org.cn/>) is not playing an important role in China's software industry. Due to the long history of China's planned economy, usually the government has played a strong role in industry development; therefore, almost all the non-government organizations are loosely organized and lack the resources and expertise in facilitating the participating companies. By nature, the OSS movement will need more coordination than any other proprietary software development. The Chinese government needs to foster the development of such institutions that can coordinate domestic OSS developers and perform dialogue with international peers.

5 Summary and Conclusion

In this paper, we have discussed how the OSS movement can be leveraged to stimulate growth of the software industry in developing countries, using China as a case study. As well as an analysis of the economic characteristics of OSS, which implies it is a public good whose value could be fully transferred. We also make a survey of the status of China's software industry, looking for reasons why OSS is a feasible choice for Chinese government to develop the software industry.

We argue that OSS will help China solve the piracy problem, as well as change the competitive

landscape of the software industry. In particular, we propose that the Chinese government take the following actions to promote OSS: 1) Subsidize the software sector especially the R&D efforts in OSS; 2) Adopt OSS in the public sector; 3) Promote OSS education and training; 4) Foster industry institutions that coordinate collaboration in developing OSS products. All these policies will not tip the playing field of OSS vs. commercial software, instead they are meant to increase the awareness and competitiveness of OSS so the competition outcome, whether or not OSS wins, will improve the overall social welfare.

References

- [1] Hippel E Von, Krogh G von. Open Source Software and the 'Private-collective' Innovation Model: Issues for organization Science[J]. *Organization Science*, 2003, 14(2): 209-223
- [2] Lerner J, Tirole J. Some Simple Economics of Open Source[J]. *Journal of Industrial Economics*, 2003, 5: 197-234.
- [3] Lessig L. Open Source Baselines: Compared to What? In: R. Hahn, Ed, *Government Policy toward Open Source Software*[M]. Washington, DC: Brookings Institution Press, 2002
- [4] Ju D. China's Budding Software Industry[J]. *IEEE Software*, 2001, 18(3): 2-5
- [5] Hahn R W. (ed.). *Government Policy toward Open Source Software*[M]. Washington, DC: Brookings Institution Press, 2002
- [6] Porter, Michael E. *Institutions for Collaboration: Overview*[M]. Massachusetts: Harvard Business School Press, 2003

Brief Introduction to Author(s)

LI MingZhi (李明志) was born in 1967. He received his Ph.D in Economics from the University of Texas at Austin. He is now an Associate Professor at the School of Economics and Management, Tsinghua University.

Zheng Jie (郑捷) was born in 1980. He received the Bachelor Degree of Economics from Tsinghua University in 2003, and now is a candidate for the Master Degree of Economics in Tsinghua University.