



Applying open innovation in business strategies: Evidence from Finnish software firms

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ABSTRACT

Our study aims at shedding light on the innovative business strategies in the software sector and understanding better the economics that underlies the supply of Open Source Software (OSS). We use survey data collected from 170 Finnish software companies to investigate how different properties of software firms, such as size, age, intellectual capital, absorptive capacity, and ownership structure affect their decisions to base their business strategies on OSS supply or proprietary distribution of products and services.

Our empirical findings indicate that the adoption of technologically advanced strategies requiring complex legal and managerial knowledge, such as the OSS supply strategy, demands relatively highly educated employees. The support for and development of an education system providing highly skilled people from different fields are essential for the firms' successful adoption of innovative business strategies. We also find that market entrants have largely driven the OSS adoption, but there are no significant age-related differences in the adoption behavior of incumbent software firms.

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1. Introduction

Software producers are provided with appropriation regimes that are stronger than ever and can protect their products as intellectual property by both patents and copyrights (Cowan and Harison, 2001). By establishing monopoly rights over new applications, firm developing software expect to recoup their investments in R&D and product distribution, generating revenues for long periods.

Open Source Software (OSS)² is a privately produced public product and its source code can be downloaded from the Internet and used free of charge. In theory, we should not see many commercial OSS products and their OSS development should be rather limited, as OSS attempts to go against economic logic by

not exploiting the legal framework to generate monopoly revenues from proprietary products. However, in reality, the number of OSS projects (both voluntary and commercial) continuously increases, ranging from ones focusing on small utilities and device drivers to those targeted to develop large and complex packages, such as Apache, Open Office, and MySQL. OSS has proved to be a viable mode of innovation and software production: some OSS projects capture substantial market shares from commercial competitors, introducing novel features and superior performance.³ The Linux operating system, initially developed by the Finn Linus Torvalds, is a paragon of an OSS product that successfully competes with rival proprietary products (such as Microsoft's operating systems) and it is continuously improved by a large community of programmers and users.

In the past few years, OSS development has rapidly shifted from a model driven purely by communities of developers and applications supported mainly by the academic milieu toward commercial environment as many software companies have adopted the OSS supply-based business strategies. The possibilities offered by the

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² OSS is freely distributed online, can be used and developed by all and hence it is non-excludable like other public goods. OSS relies on volunteers for the provision of new code, bug fixes of the existing code, online help with problems running and installing the program. See <http://www.opensource.org/docs/definition.plain.html> for the definition of the Open Source. Taxonomy of Open Source licenses is at <http://www.opensource.org/licenses/>.

³ For instance, Kuan (2001) suggests that OSS outperforms commercial proprietary software by comparing bug resolution rates in OSS and proprietary applications as a proxy for quality.

OSS have attracted new SMEs providing products and services by applying freely available products. Importantly, OSS has also reshaped the business models and strategies of large firms, including such major industrial players as IBM, Oracle, Philips, Nokia, and SAP, which have chosen to integrate OSS applications into their R&D activities, core products, and services.⁴

There is a vast literature on Open Source focusing on the technological and business aspects of OS applications⁵ (Raymond, 2001; Feller and Fitzgerald, 2002; Fink, 2003) and on cost-saving effects achieved by substituting proprietary programs with equivalent OSS applications (see, for example, Fitzgerald and Kenny, 2003a). Only relatively recently have economists begun analyzing the economic mechanisms underlying Open Source communities and the incentives that facilitate OSS development⁶. For example, Lerner and Tirole (2005) explore the properties of OSS licenses using data from 40,000 OSS projects. They conclude that projects geared toward end-users tend to have relatively restrictive licenses, while those oriented toward developers, the Internet, or commercial operating systems use less restrictive terms. Bonaccorsi and Rossi (2003a,b) conducted a large-scale survey of Italian firms that supply and implement Open Source solutions. They analyzed how different sources of motivation (related to social, economic, and technological aspects) determine the involvement of various groups of developers in OSS activities. However, these studies mostly aim at identifying the internal structure of OSS communities and the motives of individuals participating in them.

Some recent empirical studies shed light on the OSS business model strategies of the firms (see, e.g., Bonaccorsi et al., 2006). The study of Bonaccorsi et al. (2006) implies that firms that have adopted OSS-based business strategy tend to choose a hybrid business model comprising both OSS and proprietary software supply. It further finds that the degree of openness of the firm's business strategy is negatively related to the switching costs on the supply side and network effects on the demand side but not to firm size. The recent empirical study of Koski (2005) that explores the choices of product and license types in Finnish OSS companies is also close to our work. She concludes that firms that focus on the provision of services tend to supply their products under OSS licenses, whereas firms owned by a family or individuals tend to rely on "traditional" proprietary software in their product selection. Moreover, market trends and participation in OSS development projects affect the licensing of individual software products, such that companies developing their products as OSS tend to choose mostly the dominant OSS license type.⁷

Our empirical study aims at shedding further light on the choice of OSS as a commercial strategy by analyzing the differences between software companies that decide to supply OSS products and/or services and those that provide only proprietary software solutions. Those companies that combine OSS in their products (either purely or as part of the hybrid strategy) are denoted *OSS firms*, and those that provide only proprietary software are referred to as *non-OSS firms*. Our approach differs from those of Bonaccorsi et al. (2006) and Koski (2005) analyzing differences in the strategies of the OSS companies as we focus on the differences between

OSS and non-OSS firms by including both types of company in our dataset. Moreover, Koski (2005) used product-level data of 18 different product categories, whereas we focus on firm-level analyses.

Several case studies also explore why some software companies choose to supply OSS products and services whereas others apply hybrid strategies in which part of the product features are developed and offered as OSS and others are kept proprietary, or they employ merely proprietary supply strategies (McKelvey, 2001). West (2003) studied the shift in IBM, Apple, and Sun's strategies from development of proprietary operating systems to hybrid, Linux, and Solaris-based platforms in response to increasing R&D costs and competitive pressures from software and hardware producers. Harison and Cowan (2004) explain how different firm strategies, measured by the share of features distributed as OSS, affect the firms' profitability and the performance of their products. The results of their model suggest that rent-seeking firms adopt hybrid strategies and increase the share of OSS features in their products when revenues from complementary services and features increase.

We employ systematic data analysis (i.e. econometric analysis) to shed light on the adoption of different software supply strategies. We use survey data collected from 170 Finnish software companies to investigate how different firm characteristics affect the choice of OSS business strategies in the software sector. Our study also assesses the impact of absorptive capacity (i.e. the ability to absorb, apply, and draw commercial benefits from information or innovation produced outside the firm boundaries; Cohen and Levinthal, 1990) on the adoption of OSS-based supply strategies. Absorptive capacity plays an important role in this context, as the availability of OSS source code and applications enables virtually every Internet user to download them and establish software development or service-providing ventures. The interpretation and use of software programs and their source code typically require significant knowledge and long-term experience that most end-users lack. The commercial exploitation of OSS requires certain learning, experience, and assimilation skills. Those competences play a particularly important role in producing new OSS-based products and technologies building upon former know-how shared within and among organizations and OSS communities.⁸

The paper is organized as follows. Section 2 discusses the business strategies of software companies in the light of the economic literature. Section 3 introduces our data and the research methodology. Section 4 discusses the estimation results and Section 5 concludes and provides a summary of our main findings.

2. Software business strategies

A vast number of potential firm-level factors may affect a firm's business strategy regarding the provision of OSS or proprietary software. The contemporary empirical evidence relies, by and large, on case studies and analyses of particular projects (e.g. Dahlander and Magnusson, 2005) with few exceptions (Bonaccorsi and Rossi, 2003c; Henkel and Tins, 2004; Bonaccorsi et al., 2006). Our research aims at assessing how various characteristics of a firm affect its choices of software business supply strategies. The factors chosen for the analysis are based on the economic literature on the dynamics of innovation and firm strategic behavior, particularly those concerning the adoption of new technologies (see e.g. Antonelli, 1995; Freeman and Soete, 1997; Von Westarp, 2003). While building the econometric model, we also use the recent discussion on entrepreneurial activities that are based on provision of OSS prod-

⁴ In January 2005, IBM released 500 of its software patents for the use of OSS developers. Moreover, in November 2005, IBM, Novell, Philips, Red Hat and Sony jointly announced a creation of an Open Invention Network (OIN) that offers a collection of patents royalty-free to promote innovation around Linux.

⁵ Garzarelli and Galoppini (2003) analyze the development and production process and project organization of the Debian GNU/Linux operating system.

⁶ See, for instance, the special issue of Management Science on OSS (Management Science, July 2006, edited by Eric von Hippel and Georg von Krogh, Von Krogh and von Hippel, 2006).

⁷ This finding is consistent with the findings of Lerner and Tirole (2005) that more than 70% of the OSS development projects employ the GPL copyleft license.

⁸ Scotchmer (1991) describes technological progress as an ongoing innovative process, in which new discoveries are made by "standing on the shoulders of giants" (see also Nonaka et al., 2000).

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