

ETLA

ELINKEINOELÄMÄN TUTKIMUSLAITOS

THE RESEARCH INSTITUTE OF THE FINNISH ECONOMY
Lönnrotinkatu 4 B 00120 Helsinki Finland Tel. 358-9-609 900
Telefax 358-9-601 753 World Wide Web: <http://www.etla.fi/>

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Arto Seppä

OPEN SOURCE IN FINNISH SOFTWARE COMPANIES

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ABSTRACT: This paper explores survey data focusing on open source software supply collected from 170 Finnish software firms using descriptive statistical analysis. The first half of the report contains general data about software companies and the differences between proprietary and open source firms. The second half focuses on open source firms. A subject of analysis are copyrights, products and services supply, the firms' relationships with the open source community, and their views on opportunities and obstacles in business. OSS firms tend to be younger and are generally smaller in terms of revenue and personnel than non-OSS firms. In addition, they display more negative attitudes towards patenting. Licensing has much less impact on their sales as compared to non-OSS firms. The majority of open source products are released under the copyleft license. Network effects are seen as biggest obstacles for successful business in the open source field.

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TIIVISTELMÄ: Tämä raportti analysoi avoimeen lähdekoodiin perustuvien ohjelmistotuotteiden tarjontaa perustuen 170 suomalaisesta ohjelmistoyrityksestä kerättyyn kyselyaineistoon. Raportin ensimmäinen puolisko kuvaa ohjelmistoyritysten yleisiä ominaisuuksia sekä kaupallisia tuotteita ja avoimen lähdekoodin tuotteita tarjoavien yritysten eroja. Toinen puolisko keskittyy avoimen lähdekoodin yrityksiin käsitellen muun muassa tekijänoikeuksien merkittävyyttä, tuote- ja palvelutarjontaa, yritysten suhdetta avoimen lähdekoodin yhteisöön sekä yritysten näkemyksiä avoimen lähdekoodin uhista ja mahdollisuuksista liiketoiminnassa. Avoimen lähdekoodin yritykset ovat nuorempia sekä kooltaan pienempiä liikevaihdon ja työntekijöiden määrällä mitattuna. Avoimen lähdekoodin yrityksillä on myös negatiivisemmat asenteet patenteja kohtaan ja lisensointi vaikuttaa niiden myyntiin selvästi vähemmän kuin ei-avoimen lähdekoodin yrityksillä. Suurin osa avoimen lähdekoodin tuotteista lisensoidaan copyleft -lisenssillä. Verkostovaikutukset nähdään suurimpina esteinä avoimen lähdekoodin menestykselle liiketoiminnassa.

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1. Introduction

Open source¹ has witnessed a phenomenal growth in recent years and enjoys worldwide interest. It has changed the software industry's perspectives regarding intellectual property with its new licensing practices and has created innovative business models for corporate use. Commercially, open source has been most successful on the web server market, where the Apache-based server solutions have a dominant share. But its potential for other software market segments has been well recognized by big commercial players like Nokia, IBM, Oracle, SAP and Sun Microsystems having become participants in the open source trade. The Finnish invention Linux has become the most visible example of a successful open source project, regarded as a most likely contender for Microsoft's dominance on operating systems market. Other open source projects such as Apache, Perl, MySQL and BitTorrent were also very successful and helped shape the overall computing landscape.

This report contains the findings of the survey collected for the study "Importance of Open Source Software in Finnish Knowledge Economy" conducted by The Research Institute Of The Finnish Economy, ETLA. It is a part of European Libre Software Survey, ELISS project. The paper introduces the survey data about Finnish software companies, and especially open source software (OSS) firms.

The data were collected through a web survey² during the period of November 2004 - February 2005. A total of 591 Finnish software companies were approached through e-mail messages asking them to respond to our questionnaire in the Internet. Finally, we received a response from 170 firms (this represents a response rate of almost 30% and covers about 8% of all industrial firms in Finland) of which 73 were open source software product and/or service providers and 97 produced only proprietary products or services. Among the proprietary software producers, there were 7 firms that had previously supplied OSS products

¹ See appendix for definition of open source.

² The questionnaire used for our web survey was developed in collaboration with the Italian, Spanish, Portuguese and German partners – who undertake a similar survey, with the exception of few country specific questions, in their countries – of the ELISS (European Libre Software Survey) project.

but had decided to drop the OSS activities and concentrate merely in the proprietary software business.

The paper is organized as follows. The first half of the report (i.e. chapters 2 and 3), compares OSS and non-OSS firms, whereas the second half (i.e. chapters 4, 5 and 6) focuses on OSS firms. Chapter 2 describes some general features of the software companies and highlights differences between proprietary and OSS firms. Chapter 3 examines the role of copyrights in software product business by considering the importance of patents and licenses for both proprietary and OSS firms. Chapter 4 discusses firms' activities in the open source field, particularly the product and service supply of OSS companies. Chapter 5 presents the firms' views on open source in business, its opportunities and obstacles. Chapter 6 takes a look at the firms' relationships with the open source community. Final chapter concludes the report.

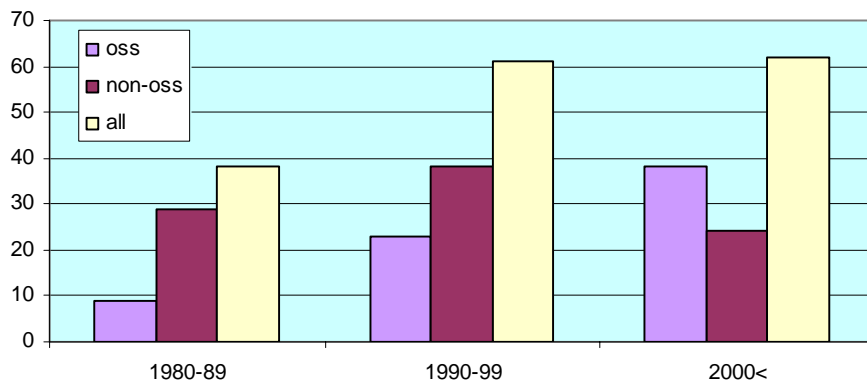
2. Firm characteristics: OSS vs. non-OSS

2.1 Year of establishment

Even though software industry in Finland is regarded as a relatively new and young industry, the age of the firms vary a lot with oldest being established way back in the 1960s. The majority of companies have still been established during the last 20 years or so. In our sample, there is a peak in between years 1987-1991 when 34 companies established, right before the economic slump of the 1990s. After the slump was over in the mid-nineties, the software industry began to grow very rapidly both in Finland and globally. Also economic growth in general led many to presume that high growth in the industry would continue unhindered in future. This is supported by the sample, showing a large number of companies founded after 1995 and especially during years 2000-2001, when there was a peak just before the IT-bubble burst. At the turn of the century, it became clear that the IT-industry was very sensitive to global economical changes. Especially internet and mobile technology companies suffered the most.

Figure 1 simply illustrates the number of firms in our sample established during the 1980s, the 1990s and between years 2000-2004. The fact that the industry is growing can be seen with the number of firms established after the new millennium, which exceeds the number of firms established during the past decade.³ Another interesting observation is that most firms established during the 1990s are non-OSS type, whereas firms established in 2000-2004 are more often OSS firms. It seems that newly founded firms tend to include open source software products and services in their product line more often than older firms do.

Figure 1. Number of firms established



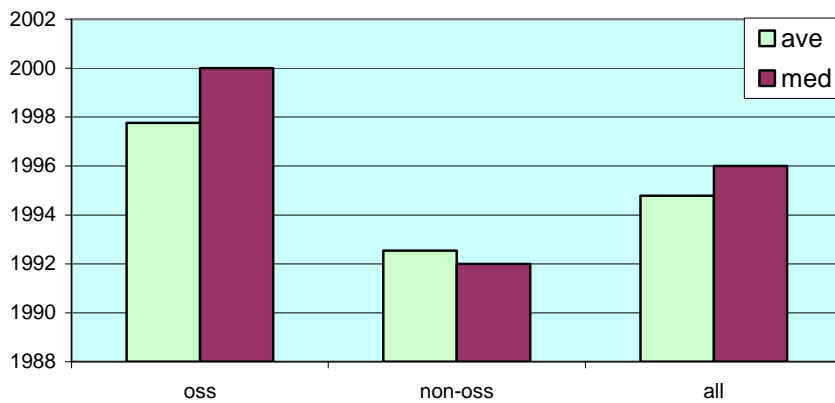
The average year of establishment of a firm in the sample is around 1995 and the median is 1996. The average age of a company is around 9 years (median 8), which is a little lower compared to a survey of Finnish software product business companies made by the Helsinki University of Technology. The National Software Industry Survey (NSIS)⁴ got an average of 11.2 and a median of 10, but the authors expected the distribution to be skewed upwards since their sample focused on the larger and therefore often older companies. Industry experts expected the average age to be lower due to the high number of start-ups in the industry.

³ Our sample does not include companies that have gone bankrupt. Therefore, there is likely to be bias towards younger firms among the respondents.

⁴ The seventh national software industry survey, which was jointly performed by the Software Business and Engineering Institute, and the Institute of Strategy and International Business at Helsinki University of Technology. The survey consist data from 196 firms in the year 2003.

Figure 2 shows the average and median years of establishment for OSS and non-OSS firms. The average OSS company is established around 1998 while non-OSS companies are about five and a half years older on average. The median year of foundation for OSS firm is 2000, hence half of these firms are established after the beginning of the new millennium. Comparing the median numbers, OSS firms are eight years younger. As one might expect, OSS firms are generally younger than non-OSS firms possibly due to the relative novelty of the phenomenon.

Figure 2. The establishment year of the firm



Organizational theory offers contradictory views on how firm's aging affects its ability to adopt new technologies and innovations (Sørensen and Stuart, 2000). On one hand, the older firm has had more time to gather resources and develop its organization to a more competent and innovative level than the younger firm. On the other hand, the older firm may prove more rigid and its ability to adapt to changing business environment is weakened. The question whether the relationship between firm's age and open source software adoption is then a subject of empirical research. Koski (2005) has studied this relationship within the range of this sample, finding that statistics of firm size and age fail to explain significantly the variation in product and license types supplied by OSS firms.

2.2 Firm size

Firms were asked about their total revenues in 2003. Figure 3 shows the median numbers for all firms together, and also for OSS and non-OSS firms separately. The average revenue for all

companies was 21,4 million Euros and median 0,54 million Euros. The massive difference between average and median is explained with a few very large observations that lift up the average. Also by looking at the median one can see that most companies are relatively small in revenue size. The National Software Industry Survey measured the average total revenue of 15,7 million Euros and a median revenue of 0,7 million Euros in the same year. The median figures are pretty evenly matched in both surveys, but the average revenue is clearly larger in our sample. This is explained by the earlier mentioned large observations in our sample. Anyway, since the medians are so similar, the both samples seem to be fairly comparable.

OSS firms have an average of 4,3 million Euros and a median of 0,31 million Euros. Once again, the high average is explained by a couple of very large observations in the sample. Median for non-OSS firms is 0,7 million Euros, indicating that they are generally larger in revenue size than OSS firms. This is due to the fact, as one might expect, that non-OSS firms are generally older as well.

Figure 3. Median size of firms

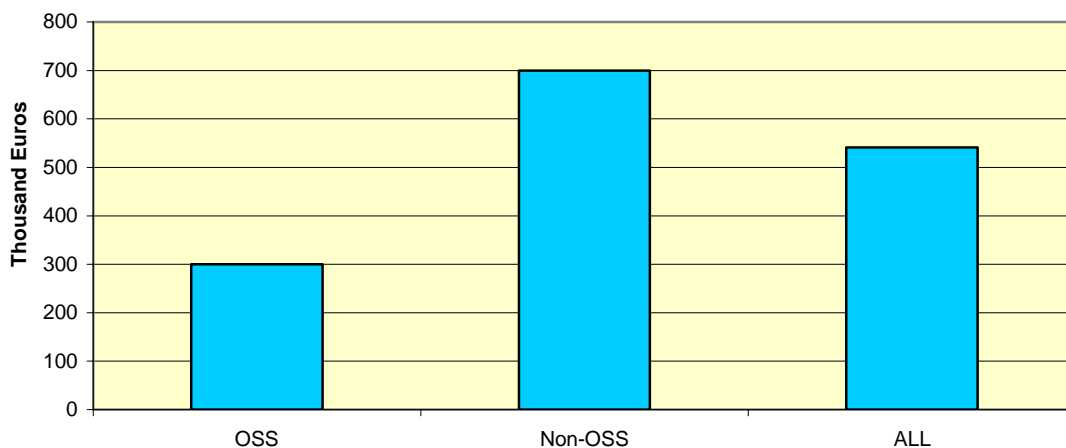


Figure 4 illustrates the distribution of all companies across four different revenue classes. Out of 134 firms that answered the question, the largest group - 49 %, belongs to the second smallest class of turnover between 0,2 - 2 million Euros. The second biggest group is the “poorest” -under 0,2 million Euro, representing 25% of the respondents. When adding up the two classes, we can see that the vast majority - 74% of the firms - are rather small

with turnovers under 2 million Euros. Still, there is nothing surprising in these figures. The NSIS found the number of firms that had revenue under 2 million Euros to be 68%.

Figure 4. Firms' distribution across revenue classes

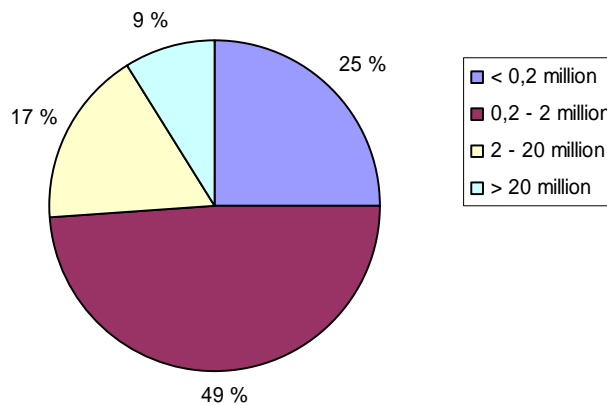
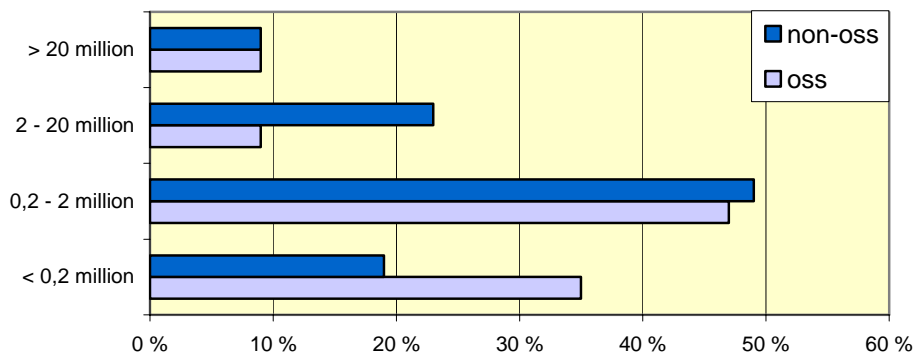


Figure 5 shows us the comparison of how OSS and non-OSS distribute across those revenue classes. Open source firms are dominant in the smallest class of below 0,2 million Euro revenues. 82% of OSS firms are below 2 million Euro revenues compared to 68% share of non-OSS firms. While the majority of OSS firms lie in the two lowest turnover classes, most non-OSS firms are positioned in the two middle classes, the 0,2-2 million and 2-20 million classes. According to these figures, the trend of OSS firms being generally smaller than non-OSS firms seems to continue. Although it is worth noticing that both firm types still have the same median class.

Figure 5. Percentage distribution across revenue classes: OSS vs. non-OSS



2.3 Personnel

The 170 companies participating the survey employed a total of 19 057 people including owners, workers and freelancers. 7029 of them were working as software developers. On average, there were 118 employees per firm (median 9) and 55 people working in software development (median 4,5). The NSIS had similar statistics with 184 companies employing 22 634 people, and 6700 working in software product business. On average, the NSIS found 123 employees per firm (median 9,5) and 34 people working in software product business (median 6).

Figures 6 and 7 illustrate the average and median number of people employed (owners, workers and freelancers) by OSS and non-OSS firms. The median figure shows only a relatively small difference between the firm types while the averages figure portrays a larger difference. The average numbers may not give the best picture of the differences between the firms in this case due to a few very large observations in non-OSS firms' side. Non-OSS firms employ more personnel in general, but the difference to OSS firms is not outstanding.

Figure 6. Personnel employed (median)

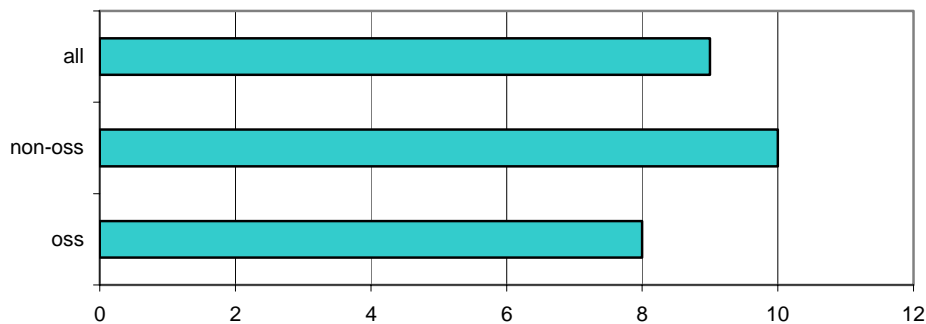
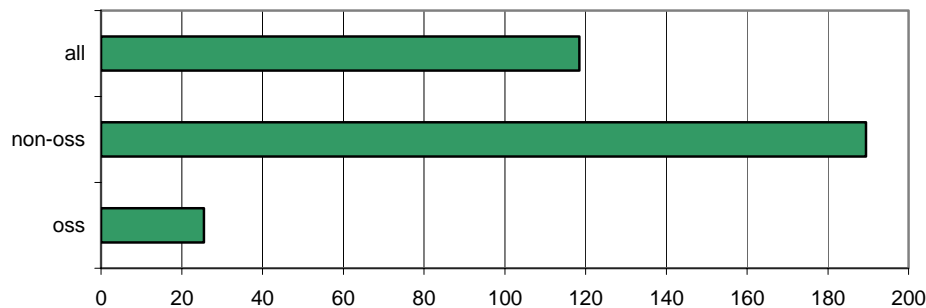


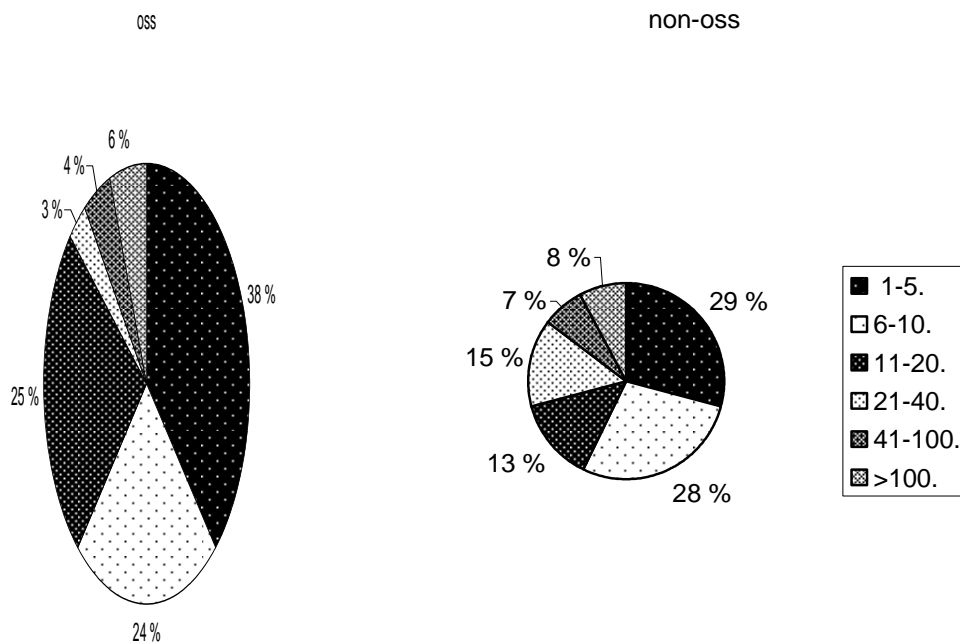
Figure 7. Personnel employed (average)



Continuing the personnel comparison between the two firm types, the portion of software developers of the total number of employees in OSS firms was 60%, while in non-OSS firms it was only 36%. The big difference in these figures might be explained by the fact that OSS firms are generally smaller and therefore they have less people doing other tasks than software development, such as marketing and other administrative jobs. So the reason why OSS firms have relatively more software developers employed is quite natural.

To support this possibility, the proportion of OSS firms that employ only 1-5 persons is 38%, while the corresponding percentage with non-OSS firms is 29%. When we move up the firm size to 1-10 employed persons, the gap decreases as the proportion of OSS firms becomes 62% and non-OSS up to 57%. Figure 8 shows the distribution of personnel in OSS and non-OSS companies by size categories.

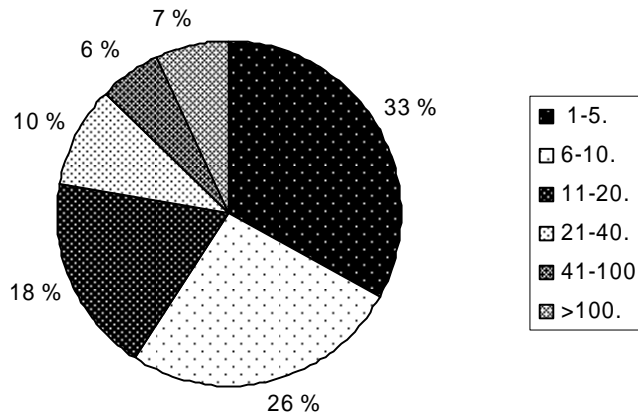
Figure 8. Distribution of OSS and non-OSS firms by personnel size categories.



Finally, figure 9 presents the distribution of all companies by their personnel size. One third of the firms have less than six employees, and 60% of firms have less than eleven employees. Only 7% employ more than 100 people. The NSIS reported nearly the same percentages in every category, except it had 27% of firms employing fewer than 6 per-

sons and 13% employing over 100 persons. This difference might be due to the previously mentioned overrepresentation of large firms in their sample.

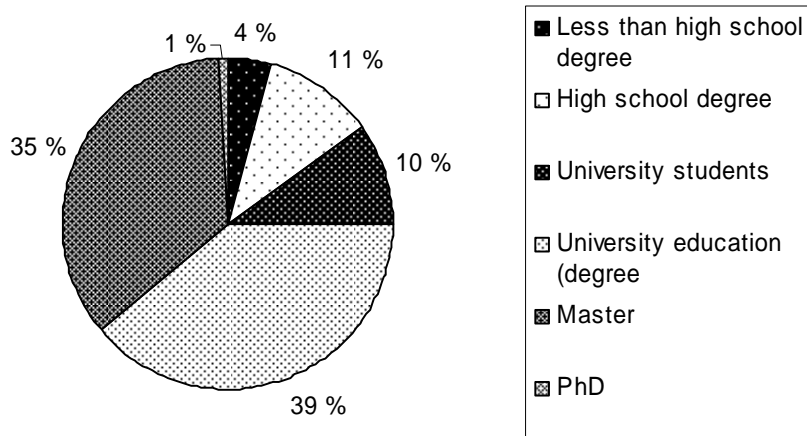
Figure 9. Distribution of ALL firms by personnel size categories.



2.4 Education

Software companies' employees are typically highly educated due to the high technology that is used in their products and services. In our sample, 74% of workers of all firms had either a Master's or a lower university degree. The amount of PhDs is still a mere one percent. University students and high school graduates both form ten percent of the distribution. Figure 10 presents the education distribution from all companies.

Figure 10. Education distribution



The comparison between OSS and non-OSS companies does not reveal any major differences; the majority of workers in both firm types have either a lower university degree or a Master's degree. OSS firms have slightly more Masters on their payroll and non-OSS firms have more lower university degree holders. The number of PhDs is one percent in both firm types.

2.5 Typical customers

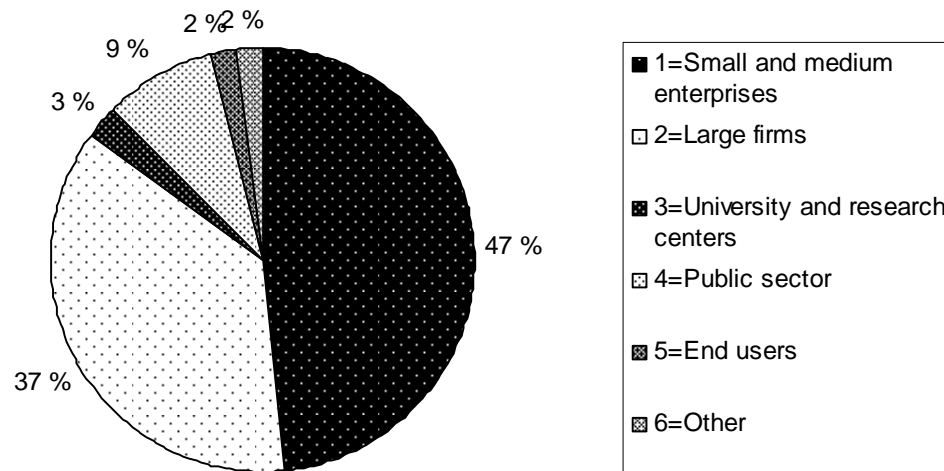
We asked the companies to name their main customer group from one of the following categories:

- Small and medium sized enterprises
- Large firms
- University and research centers
- Public sector
- End users
- Other

Figure 11 shows the percentage distribution into these categories, for all respondents. It can be seen that the majority of main customers are small and medium sized enterprises, and

large firms. Public administrations are also a considerable-sized customer group. Universities, research centers and end users are rarely the main customer group.

Figure 11. Typical customers: ALL



When comparing the distributions between OSS and non-OSS firms, no noticeable differences occur. Both firm types have small and medium enterprises as their main customer group with 49 percent share. Large firms are the second major group with a 36-37 percent share. Public sector is the most important customer group for 10 percent of non-OSS and 8 percent of OSS firms. Universities and research centers are more important for OSS firms.

3. The role of patents and licenses

3.1 The importance of licenses and patents to company sales

Copyrights play a big role in software business. Typically, the software development company owns the property rights of its products and derives profits mainly from these rights. The conventional business model is just that the company sells the customer the right to use the product, rather than the actual ownership of it. Licenses can be sold for a single user of the program, or for multiple users within an organization. In addition, the licensor or some

other company often offers support, consulting, system integration services etc. to help the customer use the software product efficiently.

The conventional software company's business model relies on the secrecy of the source code, whereas, on the opposite, the open source business model is based on the idea of releasing the source code. Releasing the source code means that the income to the suppliers cannot really come from selling copies of the software per se, since the freedom of redistribution moves inevitably the price toward the marginal cost of reproduction, which is almost zero. This means that companies have had to seek some other sources of income for their open source functions.⁵ Firms that have adopted open source into their business strategies often mix different models, not just concentrating into one. Also, most OSS firms employ hybrid business models, meaning that they offer both proprietary and open source products in their business activities. In our sample, only 10 out of 73 OSS firms offered solely open source software products or services, while the rest were employing hybrid models.

Open source software projects also have their own licensing arrangements. All major components of copyright – copying, distribution, modification – must be explicitly allowed in open source licenses. Basically there are two types of licenses, so called non-copyleft and copyleft. They differ in the degree of freedom of use and scope of regulations required for the work done under the license. For example, the copyleft licenses require that all work, such as code modification, derived from projects under copyleft licenses must be put under the same original license. Copyleft licenses are restrictive, while non-copyleft licenses are more permissive in nature and allow users even to incorporate the source code to their commercially distributed products.

Välimäki (2005, p.162) summarizes the functional features of some of the most popular licenses from copying, distribution and modification perspective as follows:

⁵ See e.g. Hecker (1999) for descriptions of open source business models.

Table 1. Copyright functionality in different license types

	Free distribu- tion	Free use	Open code	Standard copyleft	Strong copyleft	Network copyleft
Proprietary	-	-	-	-	-	-
Shareware	x	-	-	-	-	-
Freeware	x	x	-	-	-	-
BSD, MIT, Apache	x	x	x	-	-	-
LGPL, MPL, ...	x	x	x	x	-	-
GPL, PL,...	x	x	x	x	x	-
AfferoPL, OSL	x	x	x	x	x	x

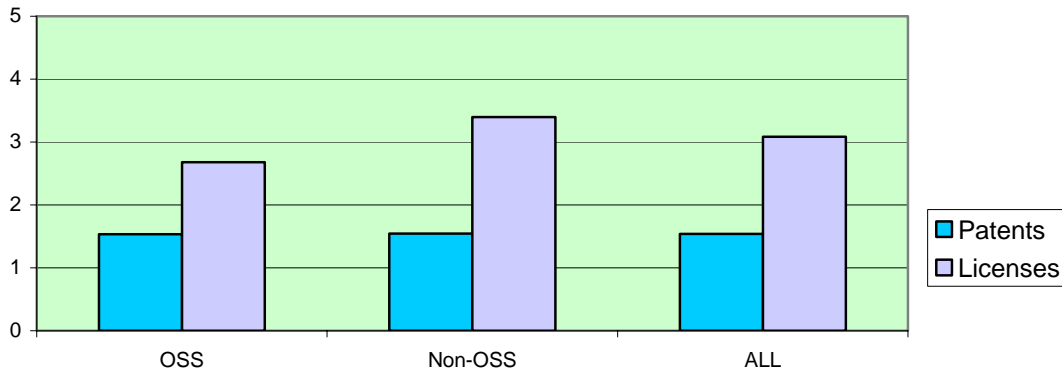
According to Välimäki, the most popular license is the GPL, with 66% of projects hosted at SourceForge⁶ using that license. The LGPL (11%) and BSD (7%) licenses followed behind.

In our survey, we asked the respondents to evaluate how important licenses and patents were to company sales. The results show that non-OSS firms generally consider licenses more important than OSS firms. Nevertheless, the difference is perhaps smaller than expected. In case of open source, the licenses are freely applicable without paying the license fee. And as the open source profit model implies that revenues must come from sources other than the license fees, it follows quite logically that licenses should not play an important role in the OSS companies' sales.

On a scale of one to five (one being not important and five being very important), the OSS firms found licenses to rate 2,7 average. Non-OSS companies had marked a 3,4 average. The difference is perhaps smaller than it would have been if the number of pure OSS companies in the sample was larger. Of course, those OSS companies that offer also proprietary products consider licenses important to their sales too. Those firms that offered *exclusively* or *mainly* open source solutions (19 firms) averaged only 1,9. Figure12 shows the average distributions.

⁶ <http://sourceforge.net/>

Figure 12. The importance of patents and licenses to the evolution of firm's sales.
Scale 1 (not important)- 5 (very important)



The role of software patents has been a subject of very keen debate recently. Europe differs significantly from the United States where software patents have become a common way to protect software innovations. The European Patent Convention (EPC) and the Finnish law do not allow patenting of software and business methods as they are. At the moment, there is a tough political struggle underway in the EU over the legalization of software patents with both sides having strong arguments for and against it. Only some months ago (06.07.2005), the European Parliament voted *against* the proposed software patent directive.⁷

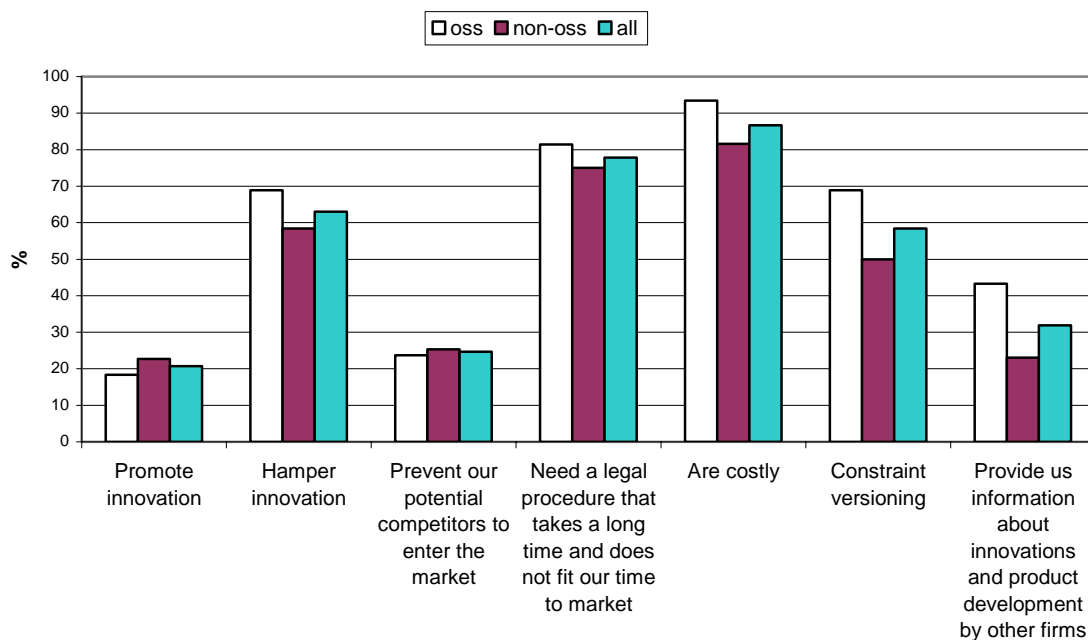
As we can see from the figure 12, patents are fairly unimportant to both OSS and non-OSS companies in the sample. Naturally, while software patents are illegal in Finland, they are not as important as licenses are to the protection of their intellectual property. If this sample would have included more firms operating at the US market - where software patenting is a widespread practice - the importance of patents would have been rated much higher.

3.2 How patents affect on firms

We asked the firms to comment “yes” or “no” to few statements about how patents affect their firm. The next figure shows the percentage of “yes” answers to each statement.

⁷ For more information see e.g. <http://www.euractiv.com/Article?tcaturi=tcm:29-142089-16&type=News>

Figure 13. How patents affect to a responding firm



Traditionally, it has been accepted that patenting encourages firms in new industries to invest more in research and development. According to studies by Bessen and Hunt (2003, 2004), this has not been the case in the US after the legalization of software patents began in the 1980s. It is typical in the software industry that firms often work with similar R&D projects separately but simultaneously. Therefore, firms have to consider the possibility that their project could end up violating some other firm's patent's rights, which would lead to the original investment becoming partially worthless. The risk of violating other firm's patent's rights weakens the incentive to invest in R&D and then may thereby slow down the technological progress. As we can see in the figure, only 20% of the firms think patents promote innovation. On the contrary, the majority of the respondents think patents actually hamper innovation.

The possibility of patenting and accidental patent infringement may lead to a strategic activity where the industry's incumbents try to pool as many patents as possible in order to prevent new firms entering the industry. This kind of strategic patenting is worthless from the point of view of society's welfare; therefore Kultti and Takalo (2005) suggest patents are not the best way to protect intellectual property rights for software. The authors find the

current situation in Finland and EU, where copyrights and trade secrets are the most common ways to protect software property rights, to be a better vehicle. They propose also some interesting new solutions which are not discussed further in this report. We asked the firms if they think patents *prevent potential customers entering the market*. Less than a quarter of them thought they do, which implies that the firms do not think patenting as a strong strategic asset, at least in the Finnish market. Of course, large companies afford to employ this strategy much better than the smaller companies, which are the majority of our sample.

Patents especially in the IT-industry are technically complex, and their processing takes a lot of time. Engaged in it is highly qualified expert and administrative staff. This means that patents are *costly* and take *long legal procedures*, a fact that the respondents seem to fully understand with 80-90 % confidence. In the US, the ever growing amount of patent applications on software innovations has led to the situation of many overlapping patents, unjustified patent approvals and a huge number of ongoing patent lawsuits (Jaffe & Lerner, 2004).

Because the patent applications are public, and because the innovation has to be very specifically explained in them, anyone who has the needed expertise can take the information of how to replicate the innovation straight from the application. This is why it is thought that patents promote the publication and distribution of private information. When the patent is in effect the public information allows new innovations, which are based on the patented innovation, to be developed. And when the patent expires, others are free to utilize the invention themselves. In case of software however, development might not be that straightforward because new technology in the IT-industry becomes obsolete rather quickly. Therefore, the innovation has usually become outmoded by the time the patent expires, and so its publication is not useful to anyone else. In our sample, one third of the respondents said patents *provide them information about innovations and product development by other firms*. Interestingly, over forty percent of OSS firms answered “yes” to this question, while the corresponding percentage was only just over twenty percent with non-OSS firms.

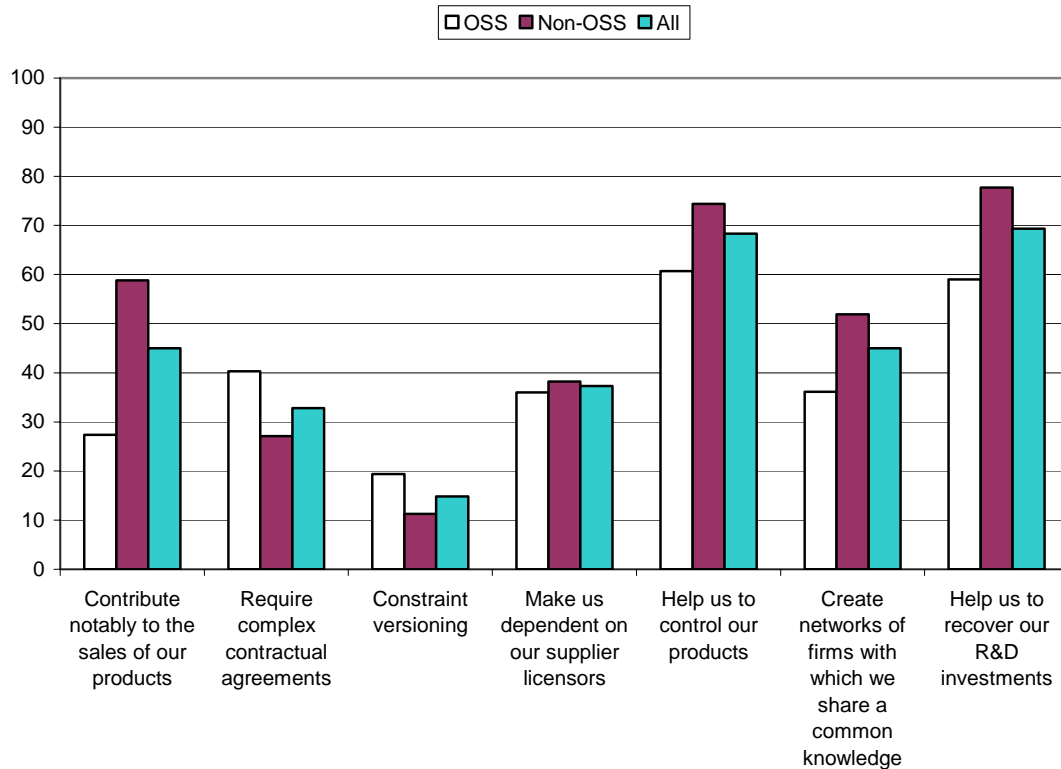
To sum up the discussion about the effect of patents on the responding firms, following points were noted from the answers:

- Firms generally think patents do *not* promote innovation in the industry. Rather, they hamper it. Also 70% of OSS and 50% of non-OSS firms think patents constraint versioning.
- Patents are costly and they need long legal procedures that do not generally fit firms' time to market.
- Patents' value as a strategic asset to the firms is low at least in the Finnish market due to the fact that software patents are illegal at the moment.
- Publicity of patent application is assessed as useful information about innovations and product development by nearly 40 percent of OSS and 20 of non-OSS firms.
- Generally, it seems that the firms do not prefer the US type patenting system, as they view these mentioned effects rather negatively. And the opinions are pretty much in line with the presented studies. Also, OSS firms seem to take a more negative stand towards patents than non-OSS firms.

3.3 How licenses affect on firms

Licenses are typically the main income source for traditional, proprietary software firms. According to the Finnish National Software Industry Survey 2004, 47 % of software firms' sales revenue came from selling and renting of licenses. Customer made projects and tailoring formed 26 % of sales, while a portion of 12 % came from customer installations. The remaining 15 % consisted user training, maintenance and customer support, etc.

We asked the firms to comment "yes" or "no" to few statements about how licenses affect their firm. The next figure shows the percentage of "yes" answers to each statement.

Figure 15. How licensing affects to a responding firm

The importance of licenses to firms' revenues differs between OSS and non-OSS companies. 27 % of OSS firms thought licensing contribute notably to their product sales, while the corresponding percentage for non-OSS firms was 59. Again, it is good to remember that majority of the OSS firms in this sample are "hybrid" in the way that they provide also proprietary software products. The importance of licenses to firm sales would probably be even lower if the sample included only "pure" OSS firms.

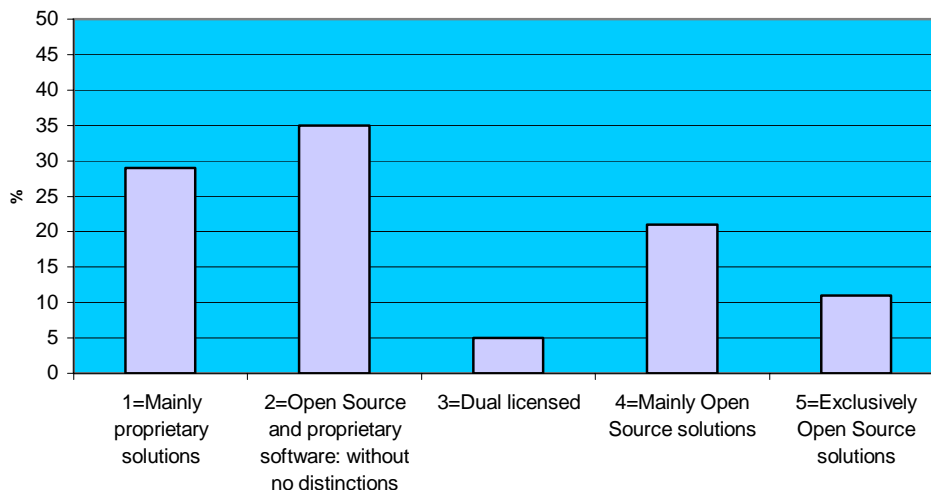
Furthermore, the majority of non-OSS firms do *not* think licenses require complex contractual agreements and also they view licenses as helping them to control the use of their products. This is not surprising at all, since firms can pretty much dictate licensing terms of their proprietary software products, and so they can control the use of their products better. In the case of open source licenses, they might be troublesome especially to those firms that develop or market their own software based on open source. Forty percent of OSS firms thought licenses require complex contractual agreements.

4. Open source software companies: products and services

4.1 General issues

Figure 16 displays the distribution of software solutions offered by the OSS firms in our sample. We can see the trend of preferring the hybrid business model with 89 % of respondents offering both proprietary and open source solutions. Out of the 63 firms that answered this question, only 10 offered exclusively open source products and services. 35 % offered open source and proprietary without any particular emphasis on either. By looking at the figure, we see that OSS firms tend to put slightly more emphasis on proprietary software than open source. It would be interesting to know what factors motivate firms in choosing between open source and proprietary software within their product portfolios.

Figure 16. OSS firms' software solutions

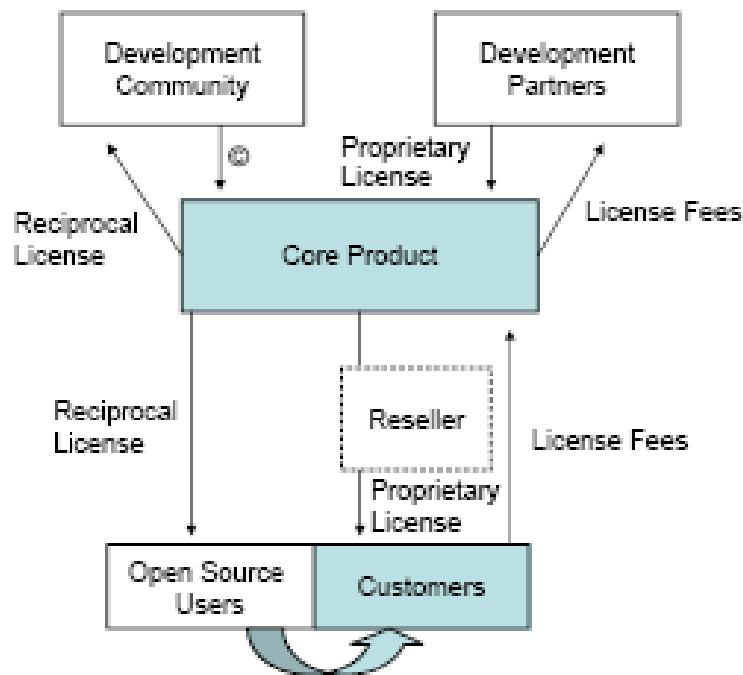


Dual licensing is a mix between open source and proprietary business models. Duality means that both the free software distribution mechanism and traditional software product business are combined. There is technically only one core product but two licenses: one for free distribution and free use and another for other uses (proprietary) of which user may choose the licensing type she prefers. (Välämäki 2005)

In the dual licensing model there can be also two developer groups. There is the vast open source community which may give bug fixes and code contributions with copyright back to the core product developers, and then the commercial development partners, which develop

essential components of the core product. The commercial development partners may either transfer or license the copyright of the component to core developers. The next figure explains the dual licensing model graphically.

Figure 17. Dual licensing (Välämäki 2005)



Dual licensing is not a commonly used business model among the firms in our sample. Only 1 % of the firms in the sample dual-license their products. Also, figures 16 and 19 witness to the model's small popularity. When thinking about the reasons of it, it must be noted that a success of the dual licensing model requires certain economic and legal pre-conditions. Legally, the firm must have undisputed rights to the licensed software product, since it allows the company to change its license policy if needed and to distribute the product with different licenses. This is important because the risk in using open source licenses is that ownership may be diluted which would render dual license impossible.

In case of dual licensing, there must be a sufficiently large user base for the product. Licensing the product with a strong copyleft clause enables strong network effects typical to information goods: the value of the product to a single user depends on the number of users it has. Also, the effectiveness of dual licensing depends on price discrimination. Managing all the rights to the product allows the company to license it according to market demand. (Shapiro and Varian, 1999)

In our questionnaire, the firms were asked to comment their customers' preferences in two areas. First they had to evaluate the importance customers ascribe to open source or proprietary products. 37 % of OSS firms estimate their customers prefer open source solutions while 16% thought they prefer proprietary solutions. Half of the respondents think customers have no preference whether they sell open source or proprietary software.

Secondly, all firms were asked to evaluate the importance of various factors - see Figure 18 for a list of factors – when their customers choose open source software on a scale of one to five. Figure 18 shows the results for OSS and non-OSS firms. First of all, by looking at the distribution we can see that no remarkable differences between the two firm types occur in any category. Top three criteria for OSS firms were security, after-sale support and operating system compatibility. With non-OSS firms, the three top criteria were price, operating system compatibility and packages that are widely used. Both firm types had source code availability as the least important criteria with OSS firms scoring slightly higher with 2,7 average.

Figure 18. Important selection criteria for firm's customers buying software.
Scale 1 (not important) - 5 (very important)

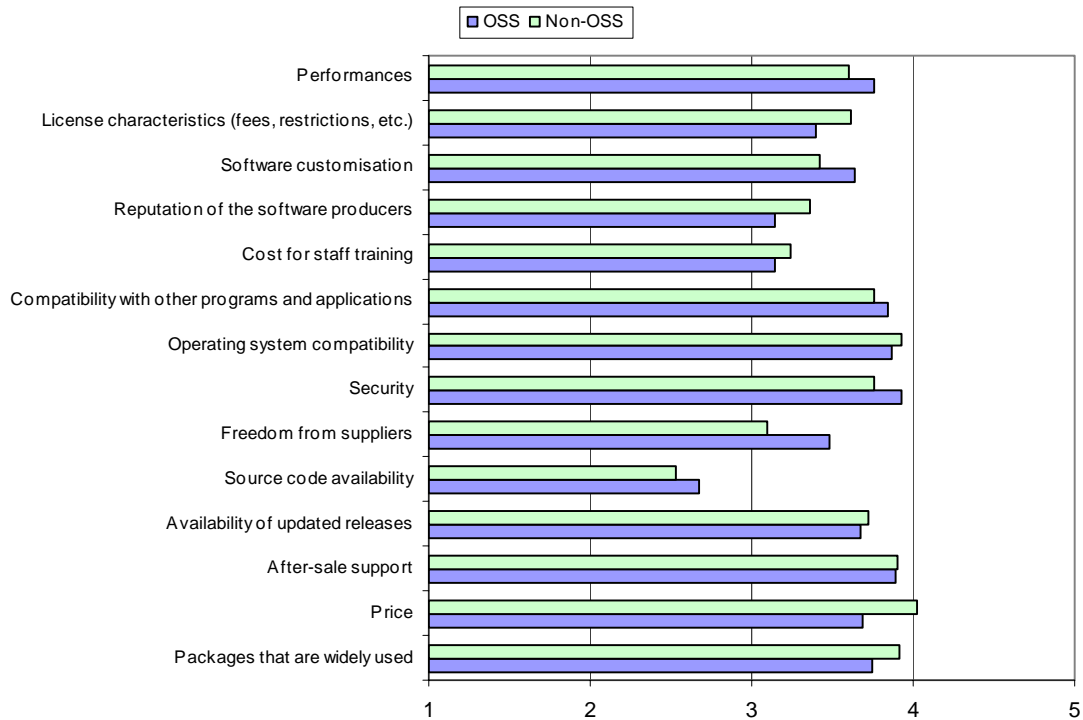
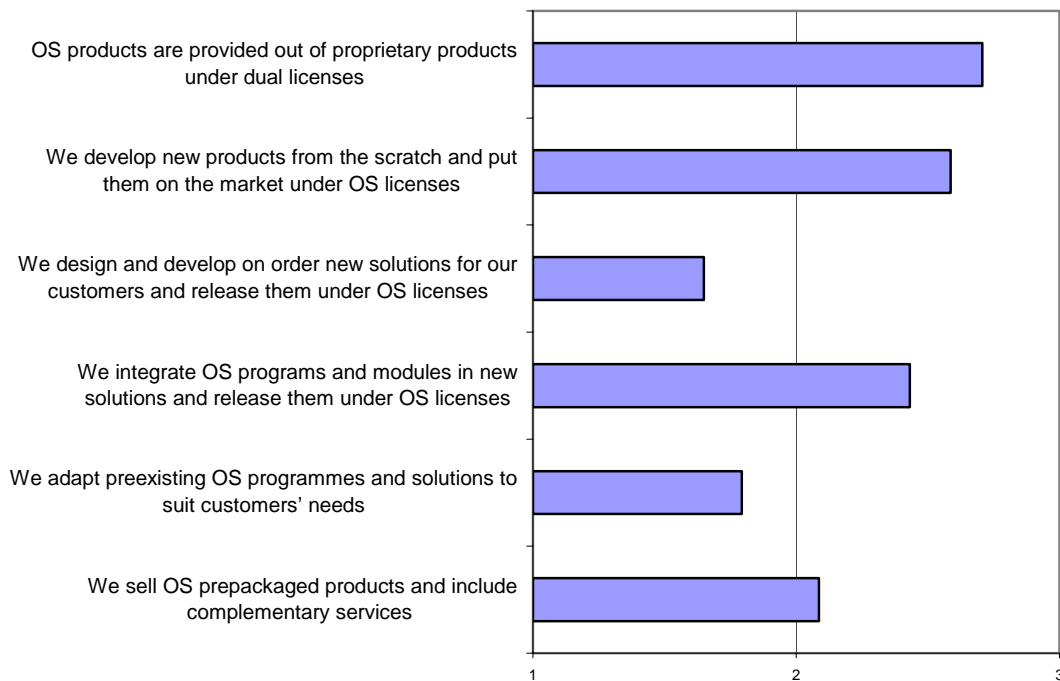


Figure 19 shows how well various proposed statements describe the business activities of OSS firms. Customer oriented approaches seem to dominate this distribution, since custom-designing and developing new solutions and licensing them under Open Source licenses is the most important activity. Also adapting pre-existing OS programs and solutions to suit customers' needs is considered important. On the contrary, dual licensing of products and developing new products from scratch are considered the least important activities on average.

Figure 19. Which statement describes firm's activities in the Open Source field?
Scale 1 (Very important) - 3 (Not important)



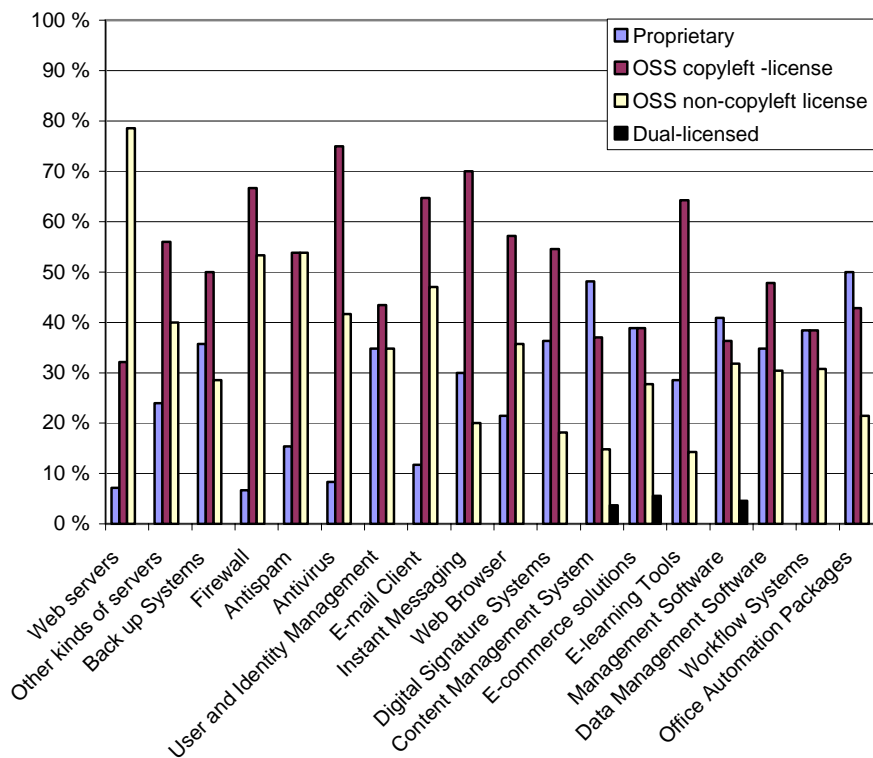
4.2 Products

An open source software firm has several different options in which way it can distribute its products. First of all, it can choose a proprietary form of release, where the source code is closed and the customer is not allowed to modify or re-use the program. Secondly, it can release the product under one of the open source licenses. In the questionnaire, we classified OS licenses into non-copyleft and copyleft licenses.⁸ Fundamental difference between

⁸ A closer look at licenses is taken in chapter 3.

them being the right customer has to modify, develop and redistribute the source code. We listed 18 product categories. The respondents were asked to report whether they supplied those products using the following options: “Proprietary products”, “Open Source products under the copyleft license (GPL and GPL-like)”, “Open Source products under the non-copyleft license (e.g. BSD, Apache)”, “dual-licensed products”. Figure 20 illustrates the resulting distribution, from which we can see that the overall percentages of copyleft products seem to be consistently high in each category. The supply of non-copyleft solutions varies more across categories. Many firms also offer both OSS and proprietary licensed products. Also, if we leave proprietary solutions out, the overall dominance of copyleft over non-copyleft is clear except for web servers. Almost 80% of the Finnish OSS firms that provide web servers use the non-copyleft license, which reflects the fact that the worldwide web server markets are controlled by Apache (see also Koski, 2005).⁹

Figure 20. Products offered by license type

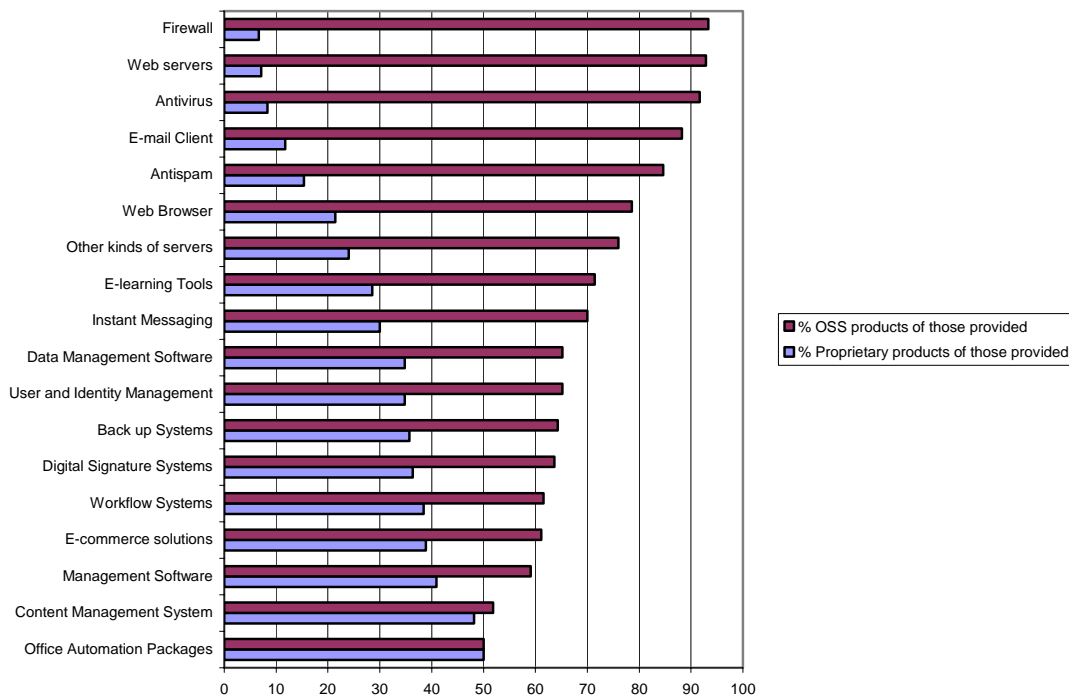


⁹ Apache has a market share of approximately 70%. See http://news.netcraft.com/archives/web_server_survey.html.

The most popular license type of all products is copyleft (46% of supplied products), while the proprietary (31%) option is more used than non-copyleft licenses (22%). Looking only at OSS products, 66% of them are released under copyleft license, 32% under non-copyleft license and mere 2% are dual-licensed. The 66% of copyleft licenses is fairly close to 72% that Lerner and Tirole (2005) found from their sample consisting over 38 000 OS projects.

Figure 21 shows the provision of software products between OSS and proprietary products. Firewalls, web servers and antivirus solutions are the most often distributed products under OS licenses. Office automation packages and content management systems are the least likely to be released under an OS license, according to our sample.

Figure 21. Licensing of products by category: OSS vs. proprietary



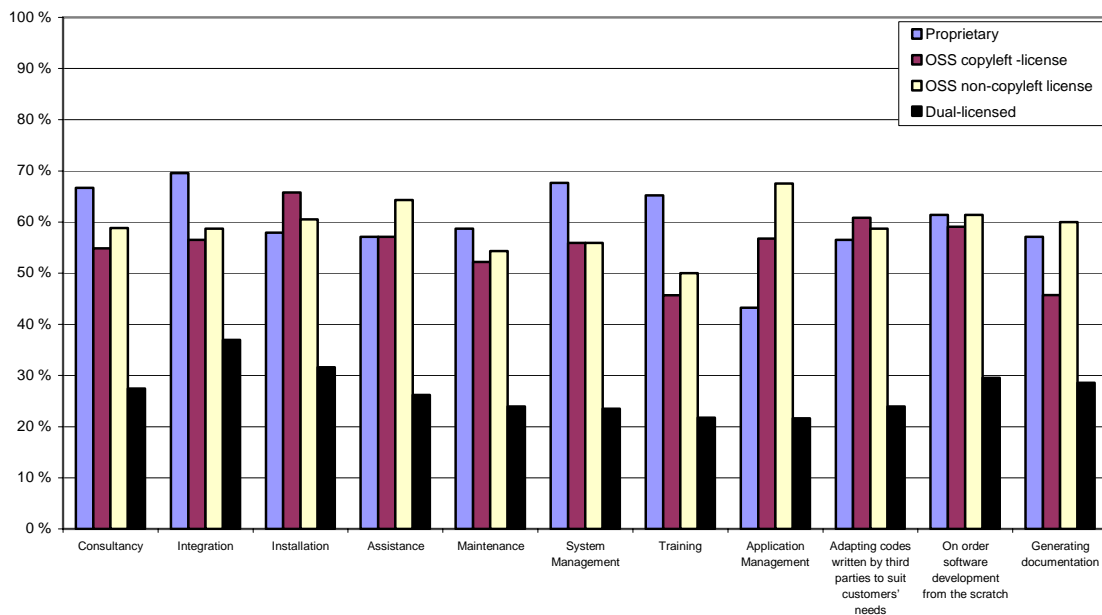
Finally, Table 2 shows how much the firms supply different products. Nearly half of the respondents offer office automation packages and other kinds of servers. E-learning tools and Data Management Software products are offered by fewer than 20 percent of the responding open source firms.

Table 2. Percentage of firms offering the corresponding product

Office Automation Packages	Other kinds of servers	Content Management System	Back up Systems	Antivirus	E-mail Client	Web Browser	User and Identity Management	E-commerce solutions
48 %	46 %	43 %	39 %	39 %	38 %	30 %	29 %	25 %
Antispam	Firewall	Instant Messaging	Management Software	Web servers	Workflow Systems	Digital Signature Systems	E-learning Tools	Data Management Software
23 %	23 %	23 %	23 %	21 %	21 %	20 %	18 %	16 %

4.3 Services

In addition to the products, we formed 11 different service categories. The respondents were asked to report which license types products were included in their services, under the same classification: “Proprietary products”, “Open Source products under the copyleft license (GPL and GPL-like)”, “Open Source products under the non-copyleft license (e.g. BSD, Apache), “dual-licensed products”. Figure 22 displays the services open source firms offer and the distribution of licenses. The overall percentages between both OS-licenses and proprietary licenses are pretty even across different service categories. Also, the service supply for dual-licensed products is consistently between 20-35 percent levels across each category.

Figure 22. Services offered by license type

It is easier to include more services than products in a firm's business model. This is shown in Table 3, with offering percentages being considerably higher in service than product categories. Therefore, a typical firm offered more various services than products in its business model. There were eight open source companies in the sample that did not supply any products compared to just one that did not offer any services.

Table 3. Percentage of firms offering the corresponding service

Consultancy	Integration	Adapting codes written by third parties to suit customers' needs	Maintenance	Training	Assistance
91 %	81 %	81 %	79 %	79 %	74 %
On order software development from the scratch	Application Management	Installation	Generating documentation	System Management	
73 %	65 %	67 %	60 %	58 %	

5. Open source in business: challenges and opportunities

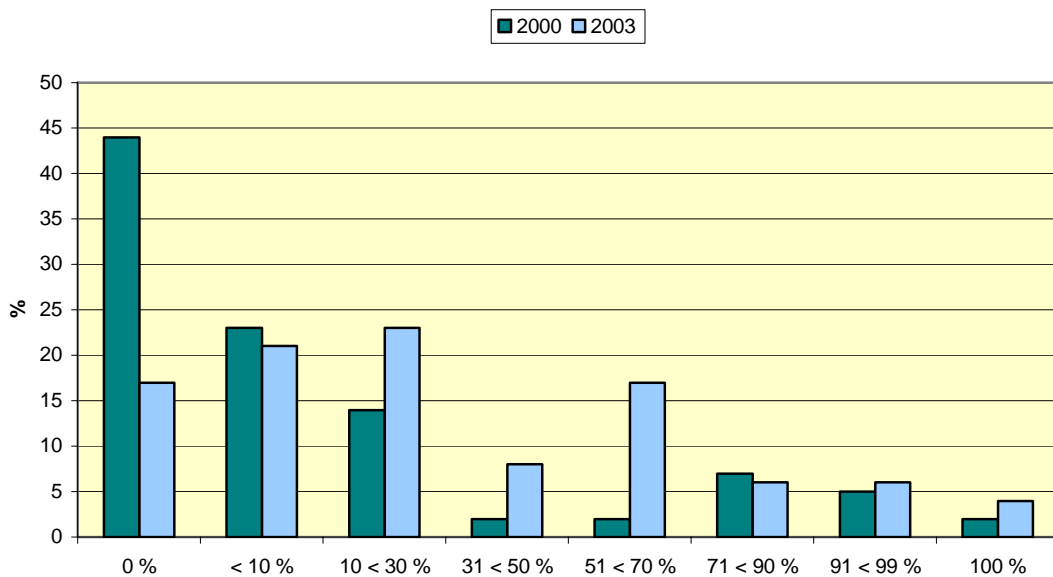
The global corporate interest towards open source grew in parallel with the Internet boom during the late nineties. Netscape was the first well-known firm to announce an open source strategy in January 1998, followed later by IBM, Oracle and other big software companies. The Open Source Initiative (OSI)¹⁰ was also founded at the time in February 1998. Since those days the industry has gradually adapted open source in to the big businesses and its popularity seems to be growing steadily. The role of OS in business strategies has become more important.

The OSS firms in our sample were asked to evaluate the extent of their turnover, composed from open source business both in year 2000 and 2003. The idea was to see how the importance of open source had changed during those years. As one might expect, its emphasis has been growing. Figure 23 presents the distributions for these two years. In year 2000, only one firm out of five generated more than 30% of its revenue from OSS, while three

¹⁰ <http://www.opensource.org/>

years later, the ratio was two firms out of five. We can see the emphasis shifting from left to right indicating that open source has increased its earning potential in three years. This movement shows in all the categories, although the effect diminishes with the larger percentage of turnovers.

Figure 23. Percentage of firm's turnover generated by OSS: 2000 and 2003



There are some industry studies that explore the risks and benefits companies face when implementing OS in their businesses. For example, Forrester Research interviewed in 2004 IT managers from fifty North American companies worth \$1 billion or more to name benefits and challenges of open source.¹¹ Low cost and the possibility to choose between different providers were the most frequently mentioned benefits. Also quality was mentioned fairly often. Modifiability, one of the most important aspects that differentiate open source software from closed source, was perhaps surprisingly not among the key benefits. The biggest challenges of OS were considered to be the lack of commercial support, and licensing and security issues.

¹¹ See Välimäki (2005) pages 38-39.

In our questionnaire, we asked both OSS and non-OSS firms to name three *obstacles* to open source diffusion out of a list of eleven different options. The top three listing for the OSS firms are following:

1. Open source software still not being widely used
2. The widespread use of incompatible proprietary applications
3. Commercial strategies of the proprietary software firms for stemming open source software diffusion

And for non-OSS firms:

1. Open source products have a worse after-sale service than their proprietary equivalents
2. The widespread use of incompatible proprietary applications
3. Open source software still not being widely used

As we can see, both firm types view mainly the same issues as biggest obstacles. It seems that network effects are still working against OSS as “still not being widely used” is regarded as a major obstacle for OSS diffusion and as there is a lack of commercial support due to the dominance of incompatible proprietary applications. OSS firms also view the strategic actions of proprietary firms as an important hindrance. The most frequently mentioned impediment among non-OSS firms was the worse after-sale service than their proprietary equivalents – a case with over fifty percent of respondents mentioning it. This is rather surprising, since the whole OSS business model emphasizes additional services.

The non-OSS firms were also asked to choose motivations for the firm *not to offer* OSS solutions, three stood out:

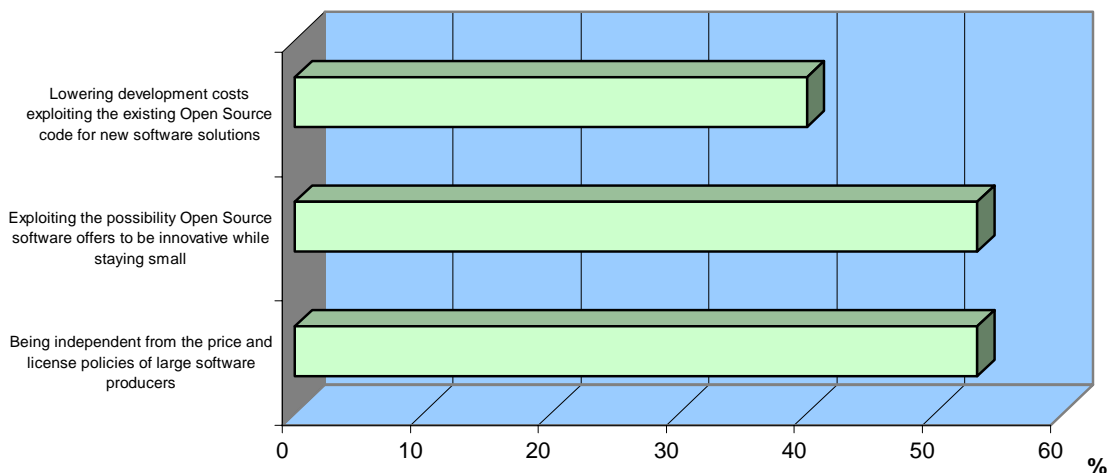
- We have no demand for this kind of software
- Open source software does not allow to make profits
- We do not want to work with OSS licenses

These motivations are not surprising, because demand dictates the supply of software and it is very hard to earn profits with OS licenses. Unwillingness to work with OS licenses is

probably due to viral effect of the copyleft license and the other complicated (legal) issues in open source license properties.

We also acquired information about the incentives that have lead firms to offer open source solutions to its customers. This part of the questionnaire was obviously directed only to the OSS firms. Three most important incentives are shown in figure 24. The low cost issue is obvious in case of open source, but it is not the most important incentive. The possibilities of being a innovative small firm and to be independent from price and license policies of larger firms are the top incentives. It is easy to conclude that these incentives are emphasized due to the large number of SME's in the sample. Nevertheless, this gives interesting information about the firms' motivations to provide OSS.

Figure 24. Top three incentives to provide open source software



6. Relationships with the Open Source Community

The final section of the questionnaire considered open source projects and the firms' participation in them. We first make a few definitions. **An open source project** is a software development project showing the following features

- The code is freely available on the Internet
- The code is released under an open source license
- Collaboration among developers shapes the software production model

Taking part in an open source project means giving concrete contributions to software development and improvement. For instance

- Downloading the code, installing the software and providing feedback on how it runs
- Writing documentation (and/or translating the existing documentation into another language)
- Reporting bugs
- Fixing bugs
- Contributing code
- Providing user assistance within the project's mailing lists

Coordinating an open source project means managing all the activities dealing with software development. For instance

- Defining project's goals
- Releasing very often new versions
- Motivate the community to provide contributions
- Settling conflicts among developers
- Avoid forking

Only 24 firms of the respondents have taken part in OS projects. The average number of OS projects that one firm has participated is 6,5 with the lowest number being 1 and highest 25. The average number of projects a firm has coordinated is 2,4 with the lowest being 1 and highest being 10. These figures suggest that in Finland, the firm level participation to and coordination of OSS projects is still quite modest.

Tables 4 and 5 show what kind of open source projects firms participated during year 2003 and what kind of feedback and contributions they received from them. Bug fixing seems to be the most important activity with nearly 80 percent of firms involved in it. Contributing

code and documentation are also common activities. Similarly, the same activities are the ones that firms get the most feedback and contributions from, especially code and bug fixing.

Table 4. Participation percentages of firms involved in OS projects

	Writing documentation	Fixing bugs	Providing user assistance within the projects' mailing lists	Contributing code that was accepted in projects' official versions	Contributing code that was NOT accepted in projects' official versions
Yes	54,2 %	79,2 %	45,8 %	62,5 %	38,1 %
No	45,8 %	20,8 %	54,2 %	37,5 %	61,9 %

Table 5. Feedback and contributions received from OS community

	Documentation	Bug fixing	Customer assistance within the project's mailing lists	Code
Yes	60,0 %	65,4 %	39,1 %	70,8 %
No	40,0 %	34,6 %	60,9 %	29,2 %

Looking at a firm's motivation in open source projects, both as an institution or by allowing its employees to participate, we found following reasons to be the most popular:

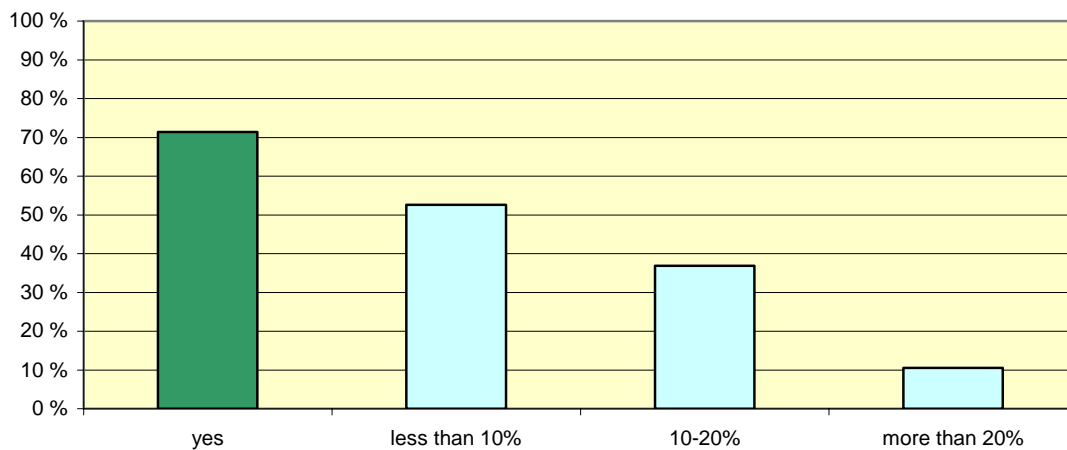
- The whole society takes advantage of the development of open source (46%)
- Taking part in open source projects allows our developers to enhance their competences (43%)
- We agree with the values of the open source movement (36%)
- Being acknowledged as active members of the community of open source developers (36%)

Interestingly, intrinsic motivations¹² seem to play an important role in the firms' motivations. This might sound surprising, since extrinsic motivations relate to immediate or delayed benefits, typically through monetary compensation, therefore being typically more important to commercial firms. Of course, the development of firm's programmers' skills,

¹² "Intrinsic motivation is defined as the doing of an activity for its inherent satisfactions rather than for some separable consequence. When intrinsically motivated, a person is moved to act for the fun or challenge entailed rather than because of external prods, pressures or rewards" (Ryan and Deci, 1985).

getting commercial visibility, directing projects to the firm's own interests and being acknowledged are extrinsically emphasized motivations, but looking after for the society's advantage and agreeing with the values of open source movement indicate signs of intrinsic motivation.

Figure 25. Can employees participate in OSS during working hours. If yes, how much time do they spent on this activity on average



Finally, we asked do the firms authorize its employees to contribute to open source projects that are not directly related to its own during working hours, and if they do, how much time they spend on this activity on average. Figure 25 shows that the majority does indeed authorize these activities, but the allocated time for this is typically less than ten percent of the employees working time. Nearly half of the firms do allocate over 10% of the employees' time to contribute into these projects.

7. Conclusions

The global interest towards open source grew together with the Internet boom during the late nineties. Since founding of the Open Source Initiative in February 1998, the software industry has gradually adapted open source to big businesses and its popularity is still growing steadily. The role of open source in business strategies has become more important, which can be seen also in the Finnish software industry. Within our sample, there are more OSS firms established after the start of the millennium than pure proprietary firms.

Are there any significant differences between a non-OSS firm and an OSS firm? Their basic firm characteristics differ to a certain extent. While OSS firms tend to be younger, they are also generally smaller in revenue and personnel size than proprietary firms. This is not surprising. Older firms have had more time to gather resources and experience than younger firms.

Copyrights are typically very important to software companies. Attitudes toward software patents are generally fairly negative amongst all companies in the sample, indicating e.g. that patents do not promote innovation in the industry but rather hamper it. Also, OSS firms seem to take an even more negative stand towards patents than non-OSS. However, the effects of licenses on firms vary even more. Only 27% of all OSS firms think licensing contributes notably to their sales compared to 59% of non-OSS firms. Open source software firms also consider license contracting agreements to be more complex than proprietary firms.

As for open source licensing, copyleft-licenses are most popular with 66% of open source products being licensed under them. In fact, each product category in our sample was dominated by copyleft over non-copyleft except for web servers, which are licensed under in 80 : 20 proportion.

Both OSS and non-OSS firms have similar views about the obstacles hindering open source proliferation. They consider network effects like “OS software still not being widely used” and “the widespread use of incompatible applications” as biggest threats to open source’s success. Reasons not to offer open source solutions were unwillingness to work with OS licenses and an attitude that OS prevents the firm from making profits. On the other hand, independence of price and license policies of large software producers, lower development costs and a chance to be innovative while being small were the most popular motivations to offer open source products and services.

Open source software is still a fairly unknown area for researchers, and the field needs more of both theoretical and empirical studies that would shed light to the technology. There have been studies about motivations of individuals contributing to open source and characteristics of OS projects, but especially more studies concentrating on relationships between the open source community and commercial actors are needed. The characteristics of various open source business models and their effectiveness will be an interesting area

for further research. An interesting subject also are the factors determining a firm's choice towards open source or proprietary software.

References

- Bessen, J. and R.M. Hunt (2004), "An Empirical Look at the Software Patents". Available at: <http://www.researchoninnovation.org/swpat.pdf>.
- Bessen, J. and R.M. Hunt (2003), "Software Patent Experiment", *Proceedings of OECD Conference "Patents, Innovation and Economic Performance"* OECD, Paris.
- Deci, E. L. and R.M. Ryan, 1985. "*Intrinsic motivation and Self-Determination in Human Behavior.*" Plenum Press, New York.
- Hecker, F. (1999), "Setting Up Shop: The Business of Open-Source Software". Available at: <http://www.hecker.org/writings/setting-up-shop>.
- Jaffe, A. and J.Lerner, (2004) "*Innovation and Its Discontents. How Our Broken Patent System is Endangering Innovation and Progress, and What to Do About It?*", Princeton University Press, Princeton.
- Jokinen, J-P.;Hietala, J.; Mäkelä, M.; Huurinainen, P. ; Maula,M. ; Kontio, J. and E. Autio (2004), "*Finnish Software Product Business: Results from the National Software Industry Survey 2004*", Helsinki University of Technology, Helsinki. Available at: http://www.swbusiness.fi/uploads/reports/1106744658_Ohjelmistoyrityskartoitus_2004.pdf
- Koski, H. (2005), "OSS Production and Licensing Strategies of Software Firms", *Review of Economic Research on Copyright Issues*, 2005, vol. 2(2) pp. 111-125
- Kultti, K. and T.Takalo (2005), "Tulisiko ohjelmistojen ja liiketoimintamenetelmien patentointi sallia? Oikeustaloustieteellinen näkökulma." *The Finnish Economic Journal*, 101, 2/2005; 165-174.
- Lerner, J. and J.Tirole (2005), "The Scope of Open Source Licensing", *Journal of Law, Economics and Organization*, 21; 20-56.
- Shapiro, C. and H. Varian, (1998), "*Information Rules. A Strategic Guide to the Network Economy.*" Harvard Business School Press.
- Sorensen, J.B. and T.E. Stuart (2000), "Aging, Obsolescence, and Organizational Innovation", *Administrative Science Quarterly*, 45; 81-112.
- Välämäki, M. (2005), "*The Rise of Open Source Licensing. A Challenge to the Use of Intellectual Property in the Software Industry*", Turre Publishing, Helsinki. Available at <http://www.valimaki.org/>

APPENDIX

The open source definition

(<http://www.opensource.org/docs/definition.php>)

Introduction

Open source doesn't just mean access to the source code. The distribution terms of open-source software must comply with the following criteria:

1. Free Redistribution

The license shall not restrict any party from selling or giving away the software as a component of an aggregate software distribution containing programs from several different sources. The license shall not require a royalty or other fee for such sale.

2. Source Code

The program must include source code, and must allow distribution in source code as well as compiled form. Where some form of a product is not distributed with source code, there must be a well-publicized means of obtaining the source code for no more than a reasonable reproduction cost preferably, downloading via the Internet without charge. The source code must be the preferred form in which a programmer would modify the program. Deliberately obfuscated source code is not allowed. Intermediate forms such as the output of a preprocessor or translator are not allowed.

3. Derived Works

The license must allow modifications and derived works, and must allow them to be distributed under the same terms as the license of the original software.

4. Integrity of The Author's Source Code

The license may restrict source-code from being distributed in modified form *only* if the license allows the distribution of "patch files" with the source code for the purpose of modi-

ifying the program at build time. The license must explicitly permit distribution of software built from modified source code. The license may require derived works to carry a different name or version number from the original software.

5. No Discrimination Against Persons or Groups

The license must not discriminate against any person or group of persons.

6. No Discrimination Against Fields of Endeavor

The license must not restrict anyone from making use of the program in a specific field of endeavor. For example, it may not restrict the program from being used in a business, or from being used for genetic research.

7. Distribution of License

The rights attached to the program must apply to all to whom the program is redistributed without the need for execution of an additional license by those parties.

8. License Must Not Be Specific to a Product

The rights attached to the program must not depend on the program's being part of a particular software distribution. If the program is extracted from that distribution and used or distributed within the terms of the program's license, all parties to whom the program is redistributed should have the same rights as those that are granted in conjunction with the original software distribution.

9. License Must Not Restrict Other Software

The license must not place restrictions on other software that is distributed along with the licensed software. For example, the license must not insist that all other programs distributed on the same medium must be open-source software.

***10. License Must Be Technology-Neutral**

No provision of the license may be predicated on any individual technology or style of interface.

ELINKEINOELÄMÄN TUTKIMUSLAITOS (ETLA)
THE RESEARCH INSTITUTE OF THE FINNISH ECONOMY
LÖNNROTINKATU 4 B, FIN-00120 HELSINKI

Puh./Tel. (09) 609 900
Int. 358-9-609 900
<http://www.etla.fi>

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