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Dilemmas within commercial involvement in open source software

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Abstract

Purpose – The purpose of this paper is to contribute to the literature about the commercial involvement in open source software, levels of this involvement and consequences of attempting to mix various logics of action.

Design/methodology/approach – This paper uses the case study approach based on mixed methods: literature reviews and news searches, electronic surveys, qualitative interviews and observations. It combines discussions from several research projects as well as previous publications to present the scope of commercial choices within open source software and their consequences.

Findings – The findings show that higher levels of involvement in open source software communities poses important questions about the balance between economic, technological, and social logics as well as the benefits of being autonomous, having access to collaborative networks and minimizing risks related to free-riding. There are six levels of commercial involvement in open source communities, and each of them is characterized by a different dilemma.

Originality/value – The paper sheds light on the various level of involvement of business in open source movement and emphasize that the popularized "open innovation" concept is only the first step in real involvement and paradigm shift.

Keywords Open source, Commercialization, Open innovation, Contradictory institutional logics

Paper type Research paper

Introduction

Software development began in the USA in the 1950s and over the following decades a global organizational field emerged: a community of organizations and individuals that subscribes to a common meaning system in which participants interact with one another more often and more faithfully than with actors external to the field (Scott, 1994, pp. 207-208). The field came to consist of a meaning system, which perceived software as a technical devise. They saw it as natural that software development took place within open innovative communities in which professional developers and users shared knowledge about software products across private and public organizational boundaries. In the 1970s private companies began to stage a different meaning system, which found it natural to understand software development as a commodity subject to proprietary rights.

Within these two organizational fields – systems of meaning – different software products were developed, and the fields engaged in fierce political debates over how knowledge should be shared and money earned within software (Weber, 2004): on the one hand was an organizational field that understood and continued to understand it as

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natural to develop software within open communities focussing little or not at all on earnings, and on the other an organizational field that continued to consider it natural to commercialize and patent software. In popular terms the two original fields may be called the "copyleft" and the "copyright" fields (Gehring, 2006).

Since the middle of the 1990s, companies have begun to get involved in open source software communities – combining commercialization and copyleft-modes of innovation. These companies have been facing a dilemma: if the company builds a strong relationship with an open source software community, it needs to respect the norms in the community, and that may limit its room for maneuvering. On the other hand, the company will get the benefits of support and innovation from the community. If a company moves away from the community, it may be easier to make a profit, however it will not get the support and innovation from the community. The open innovation – term was coined by Chesbrough (2003, 2006, 2011) and extensively described in his publications is only the first step in real involvement and paradigm shift. The "open" here means that there are many ways for ideas to flow into the process and out into the market, for example, by duplicating incentives, knowledge sharing within the firm or alliance. The path to open innovation leads through redesigning business model and very strong intellectual property management (Chesbrough, 2006). The company can both bring external ideas to the company ("outside-in") and take their unused ideas outside ("inside-out") (Chesbrough, 2006). Another very particular form of open innovation is involvement of the (lead) users in enhancing or creating new products and services (von Hippel, 1976, 2005; von Hippel *et al.*, 2011).

Companies have been dealing with this dilemma in different ways, and in the paper we develop a six-step graduation of companies' involvement in open source software communities. The paper is structured in such a way that we start by making a literature review of how companies have been dealing with the dilemma. We systematize the literature into six degrees of companies' involvement. Then we illustrate the six degrees of involvement by empirical cases and before doing so we describe the methods used. In the concluding section we discuss empirically observed levels in the context of the existing literature and conclude with the key dilemmas commercial organizations face.

Literature review on strategy used

Lerner and Tirole (2002) describe that since the turn of the century numerous major corporations, including Hewlett Packard, IBM, and SUN have launched projects to develop and use open source software. Other companies such as Red Hat and VA Linux have specialized in commercializing Linux, and yet another group of open source software companies have received venture capital financing. They argue that companies may employ two different strategies dealing with the interface between open (copyleft) and closed (copyright) source software development: they either imitate some aspects of open source processer, or mix an open and closed process. If companies follow the first strategy they do not get involved with open source software communities, as they will not allow users to modify their code. But these companies may, to some extent, duplicate the incentive by letting core developers build reputation connecting to specific proprietary software as with open source software development. They may also imitate the idea of open source code sharing within the company, and/or they may involve their customers in the development of their product (Langdon and Hars, 2007). In the second strategy, companies get involved with open source software communities in various ways. They may choose a rather reactive relationship with

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open source communities by allocating programmers to an open source software project. Or they may choose a more proactive strategy by releasing codes and creating some governance structure for the resulting open source process.

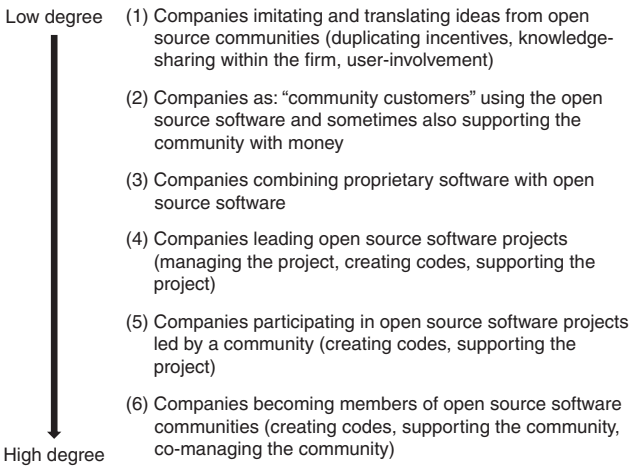
Capra *et al.* (2009) substantiate the second strategy defined by Lerner and Tirole in a survey on companies' participation in open source community projects. Capra *et al.* argue that a distinction should be made between: open source projects, which are led entirely by a company and open source projects, which are led by community members. The researchers are primarily interested in the latter situation where companies get involved in a community project. They argue that companies are profit-oriented agents and that the primary goal is to get tangible benefits from the participation in the open source project. Companies may follow different models of participation in open source communities: they may participate in creating codes; they may support the project that creates codes in other ways, e.g. they may provide financial and logistical support; and they may get engaged in administrative or managerial work within the project in order to drive the product in a competitive way for the company.

Simultaneously different ways of combining business and open source software community projects are created and new business models are created (Krishnamurty, 2005; Weber, 2004). Grand *et al.* (2004) further investigate the question of how companies engage in the creation of open source software, and they develop a four-level model of companies' resource allocation. At level 1, companies primarily use rather than develop the software. However, it is not completely without cost, as companies need technological expertise for installation and integration into the existing IT environment. Hoppenbrouwers (2007) mentions, that these companies – which he calls "community customers" – sometimes become engaged with the open source software communities by donating efforts around the product to the community. At level 2, companies like IBM and Sun Microsystems sell their products with open source software as a complementary asset. This may require major investment, as development may be needed to adapt code developed for other purposes. At level 3, open source software becomes a design choice for the way the companies develop specific new software. At level 4, open source software moves from being the design choice for a specific project to the design choice for the companies' overall business model. The researchers argue that the four levels are dynamic and have a cumulative logic of gift economy; the greater the benefits, the greater the resource investment managers have to make.

Grand *et al.*'s four levels deal with companies' resource allocation in creation of open source software going from a minimum of costs to a total allocation of resources to open source software as the overall business model of the companies. In this paper we focus on the involvement of companies with open source software communities. The question here is how the relationships between companies and open source communities are created.

The literature on companies' involvement with open source software communities shows great variations, which we systemize in Figure 1 (Westenholz, 2012, p. 28)[1]. The levels 1-3 were largely described in literature, providing various businesses as successful implementations of those strategies. Here, the authors selected the particular secondary cases to illustrate the point about lower levels of involvement.

A good example of the level 1 – "open innovation" is General Electric's (GE) initiative case on renewable energy, which was considered as a new, neighboring market to the existing core business, so-called "adjacency" (Idelchik and Kogan, 2012). In the first step they partnered the venture capitalists that support new ventures. After



Source: Westenholz (2012, p. 28)

Figure 1. Companies' involvement in open source software communities

GE announced two investment funds and the ecomagination challenge they received 4,000 ideas from entrepreneurs in 160 countries. Several of those were funded by GE directly, and those in need of further development before commercialization stage were supported by a further 20 million USD Innovation Fund. In the second step the company developed a network of business scouts to tap innovation networks in Israel, Japan, and Russia, India, China, Germany, and the USA. Lastly, they applied a structured invention platform to capture the highest value from their ventures, search for the best innovations, moderate their risk, and accelerate business growth. In the opinion of the practitioners involved in the implementation of those changes in GE Idelchik and Kogan (2012, p. 31): "tearing down the lab walls, so to speak, and collaborating with these new partners has allowed GE to see around the corner, spot new technology and business trends, and make informed strategic decisions in growing adjacencies." GE was the primary beneficiary of their investment, as the open collaboration allowed an acceleration of the scaling and commercialization of innovations and entrepreneurs helped GE to challenge assumptions about business that became institutionalized in a big corporation, while the community around GE eco-business supported them with suggestions and best solutions (Winston, 2011).

There are also companies, which become the community customers (level 2). For many years Open Office was a key end-customer OSS product, which became widely adopted in governmental and local agencies, educational institutions and some private sector companies like hotel chains, retail shops, insurance companies, or even big manufacturers (Table I).

Most Open Office users have migrated from proprietary Microsoft Office products, and this happened for various reasons. For example, American Health First Inc. 2004 decided to implement Open Office because of lack of initial investment, which saved them two million dollars, and similar reason are given by others (Fitzgerald and Kenny, 2004). Moreover Health First Inc. were able to save even further on other licensed products like Adobe Acrobat and Macromedia Flash, because of additional functionalities of Open office in comparison to Microsoft's package (Stafford, 2004). However it seems that in a public domain, organizations are also often driven by

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Type	Governments, local authorities, and agencies	Education institutions, from schools to universities	Private sector
Area			
Africa	South Africa Morocco	Namibia (300 schools) South Africa (2205 machines deployed by Novell)	n/a
Asia	Japan Malaysia Vietnam India South Korea Singapore Macau Pakistan	Philippines (Tayabas Western Academy, Asia School of Arts and Sciences and University of the Philippines) India (Parshvanath College of Engineering, Thane)	Japan (Sumitomo Electric Industries, Sumitomo Electric Industries Ltd, K.K. Ashisuto) Thailand (Bangkok Airways, EGAT) India (GB Engineering, LIC, ELCOT, ICICI Bank of India) Singapore (Resolvo Systems Pte Ltd)
Europe	Italy Denmark Latvia Hungary Belgium UK Germany Poland Netherlands France Austria Macedonia Finland Romania Spain Norway Portugal	Denmark (some schools, Copenhagen Institute of Technology, University of Southern Denmark) UK (some schools) France (some schools) Poland (Polish Academy of Science-partly) Germany (a school, University of Cologne) Macedonia (to supply all schools) Turkey (all primary schools) Croatia (school teachers' training in OO)	Romania (ASIGEST, MOBEXPERT Group, PROFI Rom Food, Total Cont-Sibiu, Zendo Computer) UK (Ford and Warren Solicitors, Future Publishing, Travel Republic) France (Groupe Laurent, Peugeot Citroën) Turkey (Kervan Gida) Germany (LVM Insurance)
North America	Some USA states Canada	USA (several schools and colleges)	USA (Blackcountry.com, JH Larson Electrical Company, Ernie Ball Guitars, Health First Inc., Life Brokerage Equity Group, Miller Industries Inc., NAFECO, Novell, Everex, Hustler Turf Equipment, Petrolink International Houston)
Oceania	Australia	Australia (Schools around New South Wales, University of Melbourne)	Australia (De Bortoli Wines) New Zealand (Egressive Ltd, MIP Holdings)
South America	Argentina Brazil Paraguay	Chile (high schools) Brazil (University of Santa Cruz do Sul, Catholic University of Minas Gerais State)	Argentina (Fen Hotels) Paraguay (Fen Hotels) Brazil (Casas Bahia)

Table I.
Examples of open office deployment

Source: Based on data from http://wiki.openoffice.org/wiki/Major_OpenOffice.org_Deployments (accessed October 30, 2012)

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democratic values such as independence and self-determination (Cassell, 2008). At the same time implementing open source software is not problem-free. Common issues are related to unfamiliarity with the software, potentially blocked functionalities, especially in documents exported form proprietary software, and difficult support for proprietary applications and also potential cost of implementation (Karjalainen, 2010). Therefore once initiated, further migration to other open source software packages is likely to happen (Stafford, 2004).

Level 3 are companies, which are mixing proprietary and open source software solutions. A successful and highly regarded business on this level is Open Xchange Ltd (www.open-xchange.com/). This company was founded in May 2005 to continue its previous incarnation as part of the SUSE Linux Openexchange Server. The founders of the company were involved in a range of software projects – both open and closed sourced – until they decided to implement a mixed strategy (Brodkin, 2007). Open Xchange offers a collaboration platform allowing its users to share e-mails, calendars, tasks, and documents generated both by proprietary and open source software. As an integration tool it allows IT administrators to migrate systems to an open source environment as well as create and implement applications without having to change their existing infrastructure components (Galli, 2005). Before Open Xchange the world of e-mail server software had long been dominated by Microsoft's Exchange and IBM's Domino packages, but that has changed since 1and1 Internet, the world's largest web hosting company, decided to roll out one million e-mail accounts running on Open Xchange's open source software (Hamm, 2007). Today the company has a good reputation on the market. It is receiving stunning reviews from its current customers. From 2006 the project was awarded several times, including the Best Linux Groupware Server in the first Enterprise Open Source Readers Choice Awards. Casadesus-Masanell and Llanes (2011) speculate that incompatibility between systems makes it more likely that more firms will adopt a mixed-source business model in the future instead of a pure open source business model.

In the fourth section, the higher degrees of companies' involvement in open source software (levels 4-6) communities will be illustrated with empirical case studies followed by the analysis. Before that we describe the research methods used.

Methodological notes

The cases describing levels 1-3 are based on secondary data: literature and news searches, companies' websites and interviews with employees and managers. The selection of cases was dictated by the clarity of relation between their business model and theoretical level of involvement (Figure 1). The choice of the cases and the accuracy of their description and representativeness were confirmed by informal consultations with the open source software developers.

The actual empirical studies were conducted to understand the higher companies involvement in open source, as this was identified as an understudied area. The cases describing levels 4-6 are based on longitudinal research conducted by the authors of this paper. They were part of a larger research project on institutional entrepreneurs, but were run as independent investigations of the particular cases. The choice of cases was dictated by their accessibility and high level of company's involvement in the open source operations. The cases were brought together at the end of the institutional entrepreneurs project and re-discussed to bring a closer understanding of what it means for a business to be highly involved in the open source and what kind of consequences may be involved. This strategy also resulted in the use of variety of

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methods depending on the access gain to the particular community and company as well as specificity and size of the project studied. For example, the TYPO3 study was focussed on the community of companies and contributors, while studies of GNOME and Maemo were conducted primarily from the Nokia's point of view. This affected not only the varied methods used but also a specific coding sheets used for analysis. As such the cases do not claim to be representative for any industry or sector, nor to be extrapolated, but provide close accounts of what is the potential scope of business involvement in open source and how this may affect the company itself. This area would need further studies.

The cases of Nokia's involvement in Maemo and GNOME are based on three-year project involving open-ended interviews, direct observations, and documentary material (Ciesielska, 2010; Westenholz *et al.*, 2012). In total 20 formal interviews were conducted – ten Nokia employees and four subcontractors working on Nokia's open source and tablet activities, as well as six independent open source software contributors. Many informal communications followed and were documented in the form of field notes. All interviews were anthropological (Fontana and Frey, 1994; Kostera, 2007), with the preliminary list of questions prepared only to initiate the conversation rather than follow them strictly (Spradley, 1979). Unstructured direct observations were made on seven separate events – conferences and meetings between 2007 and 2009, as well as during a visit to the Nokia Research Centre in Helsinki. Websites and discussion forums concerning Maemo and GNOME served as a source of netnographic data (Kozinets, 1997, 1998, 2002; Langer and Beckmann, 2005) and together with existing publications and public statements about Nokia's involvement in OSS documentary material (see Ghosh, 2006; Dittrich, 2007). The analysis of this material was constructed around themes of knowledge management, trust development/collapse, and identity struggle. The detail code sheet can be found in Ciesielska (2010, pp. 51-53).

The TYPO3 case illustrating level 6 is based on two electronic surveys, 13 interviews with managers of contributing companies and one direct observation of a community meeting. The surveys (Marsden and Wright, 2010) were conducted in 2005 and 2006 by the authors of this paper and two colleagues at the University of Copenhagen, Peter Gundelach and Benedikte Brinker. The aims of the surveys were to gain knowledge of the community and how the companies got involved with the community. The 2005 survey was carried out electronically (Sheehan, 2001) to all 5,155 members of the community defined as the participants on all TYPO3 mailing lists and newsgroups around the world. In total, 1,675 (32.5 percent) of the questionnaires were returned, which is a fairly high response rate compared to other e-mail surveys. The 2006 questionnaire was electronically mailed to 1.110 TYPO3 firms listed on TYPO3 homepages. Half of all the companies that have been approved as consultancy companies by the TYPO3 Association participated in the survey; self-listed companies, however, had a relatively low response rate. Open-ended (Spradley, 1979; Fontana and Frey, 1994; Kostera, 2007), elite (Stephens, 2007) interviews were conducted between 2005 and 2008 with the founder of the community and with 13 managers in companies in Denmark, Germany, and Holland. We also made direct observation participating in a three-day TYPO3 conference in Germany in 2006 and gathered material from the internet about the community (Westenholz *et al.*, 2012). The analysis of this material was inspired by Boltanski and Thévenot's (2006) worlds and constructed around themes of sharing and not sharing knowledge in relation to the specific practice in which companies developed software for specific customers. The detail code sheet can be found in Westenholz (2012, pp. 103, 110).

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Higher levels of involvement

Level 4: companies creating and leading its own open source software community

The level 4 companies create and manage OSS project to support its business. In the recent years, the famous, although unsuccessful story, is Nokia with its Maemo community. The Maemo.org domain was originally registered in February 2005 by Nokia Corporation and has since then remained in its assets. Not coincidentally this launch was the same year that Nokia announced its N770 device and its involvement with many upstream open source software projects. The first hackers' activities on the website are dated May 2005. Although the project websites state that the: "Maemo community is a non-profit organization sponsored by Nokia, which is an active and equal member," it was clear that Nokia's position in it is far more privileged. From the project's beginning Nokia had an overall control and ability to support only selected developers. Maemo users and developers – if they decided to collaborate – had to accept Nokia's dominance (Ciesielska, 2010, 2012; Ciesielska and Iskoujina, 2012).

In general, Nokia offered very few incentives for developers and it did not enable a payment facility for software downloads from Maemo.org by the end users. The biggest problem with Maemo.org applications was that very few of them were ever fully completed to be released for the mass market. As a result the website's community remained truly engaged – albeit at a hobbyist level, not a professional level. Maemo.org attracted "the cloud of not so serious developers" and remained mostly as a support website for users of Nokia devices. From Nokia's point of view it was not a successful undertaking, as it has not managed to provide a set of high-quality applications for Nokia's mobile phones. A lot of Maemo.org contributors and Nokia engineers felt the same way:

> I have not seen anything really useful come out of that exercise ever there are some tools that would have been developed anyway completely without having this sort of community there.

Level 5: companies participating in OSS projects led by the community

At the same time as launching Maemo, Nokia was collaborating on other projects led by the communities. One of them was GNOME – the free desktop project. The GNOME community is primarily focussed on software development and attracts wide group of contributors, including many bigger and smaller companies, like Red Hat, Google, IBM, Motorola, Oracle, Collabora, Igalia, SUSE, Code Think, Free Software Foundation, Mozilla Foundation, and many independent software developers. Although Nokia eventually became the sponsor of GNOME Foundation, it has never been able to obtain control over the project and therefore had to participate, benefit and contribute as any other member (Ciesielska, 2010, 2012).

From 2005 Nokia was open about its interest in the GNOME code repository, although they had been working on GStreamer-related technologies much earlier than that. In this initial stage they were purely a "community customer" with no contributions (level 2 of involvement). Soon they realized that this strategy had a serious flaw – it created a code fork, which prevented them from taking full advantage of the OSS development process. This problem was related to the fact that a complex system like software is very sensitive to changes and sub-optimizations. In other words: a small change may have tremendous consequences on how the software works (or stops working). Since summer 2005 Nokia tried to fix this by aligning its version of the code repository with the official GNOME one. It took them about two years to catch up (Ciesielska, 2010, 2012).

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Soon after they became a cornerstone sponsor of the annual GNOME Users' And Developers' European Conference where Nokia made a regular presentations. They also hired OSS engineers and subcontractors chosen among the original GNOME/GTK+developers, who for several years became involved in the Maemo project. The first task was to reintegrate Nokia's with GNOME's code. This was quite difficult and required not only technical knowledge, but also strategic decision making of what was appropriate for submission to the upstream. Later on, one of the Nokia OSS engineers, said that, for simple technical reasons and for simplicity of the process, they try to integrate with the upstream wherever possible:

> So we do the design and [use the] open source instead of sit down and write it ourselves. We send the patches to an open mailing list, get reviews and feedback […] and when it's done, it's merged up with upstream and then we can pull it back from there. So, in a way, rather than doing it within Nokia and pushing it out, it sort of comes back through open source, which is nice.

At the same time the expectations and needs of the open source community were growing, beyond what Nokia was offering. The basic difference between Nokia's approach to GNOME and a truly OSS-originated company was the lack of the altruistic element. Despite declarations and good engineers' intentions, the truly open collaboration was not exactly in line with the overall corporate logic. A lot of formal and informal internal rules restricted the actual OSS contributions. The protection of a possible competitive advantage was the most significant factor that created problems. The competitive advantage rule stated that any piece of code that is not a simple fix or bug report, but presents a solution never implemented before, is Nokia's competitive advantage and is an internal knowledge asset. This affected, in particular, GNOME Nokia contributors whose code was taking a long time reaching upstream, and some not at all. A Nokia employee commented on this:

> The problem is that quite often the things we are asked to do are either patented or what they call "a competitive advantage". So then they don't really want that to be shared because it is an advantage.

If Nokia open sourced anything, it was because it was better for Nokia's development process, not necessarily for the good of anyone else. Therefore over a couple of years Nokia managed to create a very bad impression of a company who was taking more than it was giving. At the same time Nokia kept parts of the Maemo operating system as a closed component[2] (Ciesielska, 2012).

The initial GNOME excitement turned into distrust. In the meantime, Nokia managed to lose its GNOME/GTK team – the majority of which resigned in 2008 due to job burnout. But the turning point in Nokia-GNOME relations was in June 2008, when they announced their acquisition of Trolltech, their Qt. application development framework – a competitive solution to GNOME/GTK+package. The next decision was to replace GNOME/GTK+with Nokia-owned Qt. Most GNOME contributors could not hide their dissatisfaction with Nokia's decision and found it very insulting that Nokia advertised Qt jobs at their conference, showing no respect for how much work the GNOME community did to make GTK+a useful tool (Ciesielska, 2010).

Abandoning GNOME without any warning proved that Nokia had a lack of respect for OSS work and achievements and fueled even more distrust toward the company. What Nokia did not realize for many years, was the importance of trust within open source software projects. As a result, Nokia started to be perceived at the opposite end

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of the scale to companies like Red Hat, which were considered a truly open source, very much immersed in the open source logic. Nokia's agenda, on the other hand, was unclear and changeable, because they have never been able to transform its strategy from closed to open software development (Ciesielska and Iskoujina, 2012).

Level 6: companies becoming members of open source software communities

This last level illustrates the highest degree of company involvement. This level is not well-described in the literature. We let the case of TYPO3 illustrate this level (Westenholz, 2012).

TYPO3 is a content management system created by a young Dane – Kasper Skaarhøj – in the late 1990s. During one and a half year he spent an incredible amount of time developing the software, which he released in 2000 on a GPL license[3]. After it was released a network of very diverse actors establishes itself around the product, which grew to thousands over the years. Some are private users of TYPO3. Others are employed in companies and use the software to develop a homepage for their own company/organization. A third group are freelancers and web bureaus selling services connected to the implementation of TYPO3. The customers do not pay for the software, which is released within the community but they pay for the specific applications and services requested by them from the company. These groups are primarily users of TYPO3, but many also take part in its development by identifying errors/bugs and developing extensions, specifically directed at the customer's needs. The core development of TYPO3 is a fourth group comprising relatively few people. They also evaluate and incorporate the suggestions they deem useful into the official version of the program. Almost all of them are freelancers loosely affiliated with a web bureau. The official TYPO3 Association was created in 2004 as a non-profit organization, and was founded to provide funds for long-term development goals that would not be possible otherwise. Since it started, the association has attracted about 600 members, companies, and freelancers alike. The funds are generated by membership fees and donations.

Companies play an important role within the TYPO3 community. Compared with non-commercial TYPO3 actors, the "commercial" TYPO3 actors use more man-hours on developing TYPO3: they interact more frequently with others about the software, they participate in social community events and to a higher degree, consider themselves to be part of the TYPO3 community on a local, national, and international level. They also feel more known in the community and often think that someone should attend to the socialization of the community. The conclusion does not mean that TYPO3 can be understood as a community of commercial actors alone. The non-commercial contributors also take part in the network around TYPO3, but the commercial ones play the central role in this network.

Diversity of actors as well as a clear business model emerging around this community allowed for a hybridization of technological, economic, and social logics. The following citation from a managing director and programmer can illustrate this:

> We have done a lot of work for TYPO3. What we develop, we like to share with others […] what we do, others enjoy and we don't think that we lose anything by publishing it. We still have the expertise and know-how when it comes to the new system […] we earn our money by getting something that other people have developed. So in this way, we enter some kind of community where we draw on [the work of] a large number of other people, and then we give back to the community as best we can. In our case, it is not just financial, but more about investing our time and publishing some of what we have created.

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The companies participate in the development of TYPO3 software in many different ways. Some companies, developing software for specific customers, release their new knowledge to the TYPO3 community. Some software developers, employed in a TYPO3 company, contribute to the development of the core TYPO3 software on a voluntary basis, together with volunteer programmers and programmers from other companies. Some of them also contribute outside of their usual work time. Several companies, working together to develop specific elements of the software, release knowledge directly to the community. But many companies, which primarily develop TYPO3 software internally, also share their code with the community (Westenholz, 2012).

Not all companies contribute back everything they have created. It happens in particular when the customers have bought the knowledge and do not want it to be public or when knowledge is so customer-made that it is of no interest to the community. However this type of non-sharing behavior is accepted in the community. But sometimes the companies get into dilemmas between the different logics. It may happen if they have spent a lot of time in developing knowledge and they want to increase their profit by non-sharing behavior. On the other hand they know that technical advantages are achieved if the knowledge is shared and they may also get sanctioned by the community if they are defined as free-riders.

Discussion and conclusions

As showed in the example cases, there are (at least!) six levels of business involvement in the open source field. Now, we will discuss those empirically observed levels in the context of the existing literature and conclude with key dilemmas the commercial organizations may face if they decide to adapt open source logic.

The lowest degree of contact is where companies imitate/translate ideas from the open source (duplicate incentives, knowledge sharing within the firm, user-involvement), but are not directly involved with the communities. Level 1 companies simply imitate the open source way of developing software but within a clearly controlled environment. In literature this new way of boosting creativity in business is covered under the term "open innovation." However, in this case the whole process of innovation is not truly open, but only those elements that are beneficial for the company, and the exchange is often one way ("outside-in" part of open innovation), for example, using existing or potential customers to suggest improvements. On the contrary, inside-out open innovation requires organizations to allow ideas to go outside to the market, but these cases are rarer, less research reports them and they seem to be less understood by the business (Chesbrough, 2012).

The next step sees companies becoming "community customers" as they use the open source software and sometimes support the community financially. Level 2 companies acknowledge the value created in the open source area, but benefit from it directly, integrating or simply using OSS in their businesses[4]. "Community customers" to a large extent are one-side beneficiaries, but some may donate or support OSS projects in a minor way.

Real involvement in the development of open source software happens in the third step, where companies sell their combination of proprietary software and open source software. Firms may deliberately try to marry multiple software modules with clear distinctions in which of them are open and which to keep proprietary. There are two potential ways of mixing software development solutions. Companies can either be based on open software, but allow closed source extensions or despite proprietary core, allow for open source extensions (Casadesus-Masanell and Llanes, 2011)[5].

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In the fourth step, companies release codes and try to build an open source software community around the project. In most cases the company has a clear lead and/or control over the project, which contributions to accept or reject and which developers to support. The OSS project serves as a supplementary or sole R&D project with clear links to the company's primary business (Ciesielska, 2010).

The fifth step is characterized by companies participating in open source software developments lead by a community. In this case the organization acts as co-developer and potentially financial supporter, but has relatively little say in terms of project management.

The last step, which illustrates the highest degree of involvement, is characterized by companies becoming members of open source software communities where they create codes, support the community and participate in its management. This level is not well-researched in the literature.

The three lower levels of involvement are fairly well-described by the literature, especially with the focus on strategy, innovation, R&D. In all cases the primary companies' logics reside in the economic spectrum, with elements of technology-related structures. Levels 1 and 2 do not pose much difficulty for the commercial organizations. Both of those levels are embedded in business activities, with clear agenda of one-sided benefits from the open source software or ideas behind it. Level 1 companies may capture innovation spill-outs from other technology areas. Their main dilemma is the choice between absolute autonomy at the expense of potential innovation or relying on external contributions to expand its creative potential. Level 2 companies benefit simply by using open source software instead of purchasing a proprietary solution. The choice between waiting for others to innovate "for free" vs buying innovation seems to be the key dilemma here. None of the choices are obviously better at providing more advanced solutions. Although the open source solutions are perceived as cheaper, the initial cost savings may be spent later on maintenance and other adaptations. Level 3 companies, can employ either purely commercial or technological logics. In both cases they remain consistent in their talks and actions. Commercially-focussed ones see a business opportunity in mixing open and closed source software, while technology-driven ones would aim at allowing open source software to be combined or compatible with the proprietary components (Table II).

In much more complicated situations companies are having higher levels of involvement, 4-6. This primarily comes from the fact that at those stages they face hard to commensurate logics of action and various stakeholder pressures. Levels 4 and 5 companies are guided primarily by economic and technological logics, but within social structures created by open source software communities. As a result the commercial actors need to develop and keep successful trust relationship with voluntary and business partners in order to secure valued and continuous contributions. While companies leading open source projects (level 4) are the primary beneficiary, companies participating in open source projects lead by an open source community are the secondary ones (level 5), with the community interest taking the first place. In both cases the main dilemma for the commercial actors is how to balance out between its autonomy and value generated by collaboration. Also the movement from levels 4 to 5 means shifting the main beneficiary from the company to the community. Level 5 companies are in a difficult position where they have little control over the open source software communities' directions, while in level 6 there is a high risk of feeding competitors with free knowledge. As a result businesses becoming involved in open source at levels 5 and 6 become vulnerable, unless they adjust their strategies and reformulate value propositions to accommodate the fact that the work they do in the

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	Level 1: company imitating or translating ideas from open source community	Level 2: company in the role of open source community 'customers'	Level 3: company combining proprietary and open source software	Level 4: company leading open source project	Level 5: company participating in open source project lead by an open source community	Level 6: company becoming member of open source community
Primary company logic	Economic	Economic	Economic and technological	Primarily economic and technological Secondary social	Primarily technological and economic Secondary social	Technological, economic ,and social
Companies type of relationship with open source communities	Borrowing ideas from open source development	Becoming a user of open source software	Developing a fit between proprietary and open source software	Financial and fully hosting an open source project	Co-developer in the project and financial supporting the community	Co-leader, co-developer, and financial supporting the community
Key actors	Company	Company	Company	Company as leader and open source community members as followers	Open source community as leader and company as follower	Voluntary developers and companies as members within the community
Company's regulative license	Copyright	Copyright	Copyright and copyleft	Copyright and copyleft	Copyright and copyleft	Copyleft
Who is benefitting from the open source software development	The company is not benefitting from the open source software, but may capture innovation spill-outs from other technology areas	The company is benefitting by using open source software internally in the company	The company is enriching its own proprietary software by adding open source software	The company is the primary beneficiary The followers in the open source community are secondary beneficiaries	The open source community is the primary beneficiary The company as a follower is secondary beneficiary	Companies, customers and voluntary developers are all primary beneficiaries
Company dilemma	Autonomy at the expense of potential innovation	Waiting for others to innovate vs buying innovation	Waiting for others to innovate vs internal innovation	Autonomy vs cooperation	Cooperation vs autonomy	Cooperation vs free-riding

Table II.
Six levels of companies' involvement in open source software communities

open is easily available to anyone. Failing to do so result in luck of trust and legitimacy, and may lead, as in the case of Nokia, to the project closure (Ciesielska, 2010, 2012).

Alternatively, if companies succeed in building trust and legitimacy they become involved in fast speeding innovative processes, which they would not have been able to

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create on their own. Furthermore software engineers actually consider their work to be fun (Hunter *et al.*, 2010) and the involvement in open source may become of personal importance and a career progression opportunity. This will create a strong pro-open source coalition inside the organization. This strong cultural basis combined with a balance between exploration and exploitation of knowledge are considered as potential success factors (Hemetsberger and Reinhardt, 2006). TYPO3 is an excellent example of how combining commercial and community interest lead to advanced technological innovation and sustainable business (Westenholz, 2012).

Theoretically our study contribute to the growing literature within institutional organizational theory focussing on different organizational responses to pluralistic, widespread institutional field logics (Boxenbaum, 2006; Feldman 2003; Oliver, 1991; Reay and Hinings, 2009; Tilcsik, 2010; Westenholz, 2012). As mentioned in the introduction software development used to be developed within either an organizational field of companies applying an institutional logic of "copyright," or an organizational field of open source communities applying an institutional logic of "copyleft." Since the middle of the 1990s, companies have begun to get involved in open source software development and our contribution is to show how software companies in six different ways have responded to this development. We also show that whatever their response has been they are facing different types of dilemmas.

Finally, we would like to mention some ideas for future research. In the paper we identify six graduations of involvement. However the number of cases, and their timescale limit the generalizability of our analysis. A more systematic taxonomy may show new global trends in commercial open source software solutions. One may also develop a new taxonomy by combining the work by Grand *et al.* focussing on four levels of companies' resource allocation and our work focussing on six degrees of companies' involvement with open source software communities. Further empirical studies may reveal even more graduations or combinations of the graduations. It would also be interesting to obtain empirical examples of successes and failures on each of the levels so a more extensive comparison could be made.

Notes

1. Copenhagen Business Press kindly accepted that we copied the figure from the book: *The Janus Face of Commercial Software Communities – an investigation into institutional (non) work by interacting institutional actors*.
2. Similarity to level 3 of involvement – mixing open and proprietary solutions.
3. Why he did not establish a business is another story – not told here.
4. The examples of commonly used open source software includes: Linux operating system, FireFox browser, Mozilla browser, Apache web server, Perl programming language, OpenOffice suite, and MySQL database.
5. The examples of the former, "Open Core" solutions are SugarCRM, Zimbra, JasperSoft, Mac OS X, while MSFT Net, Mathematica, Stata, Facebook fall in the latter "Open Edge" category.

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