

Intrinsic motivations and profit-oriented firms in Open Source software. Do firms practise what they preach?

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A growing body of economic literature is exploring the incentives of the agents involved in the Open Source movement. However, most empirical analyses focus on individual developers and neglect firms that do business with Open Source software (Open Source firms). This paper contributes to the literature by providing empirical evidence on the incentives of firms that engage in Open Source activities. Data on firms' motivations were collected by a large-scale survey conducted on 146 Italian companies supplying Open Source (OS) solutions and show that intrinsic, community-based incentives do play a role. Nevertheless, these positive attitudes towards the values of the OS community, which are quite surprising by profit-oriented firms, are not in general put into practise. Discrepancy between attitudes and behaviours is a widely investigated phenomenon in social psychology literature. We explore its pattern in our sample, find that it does not concern all the respondents, and single out a group of firms adopting a more consistent behaviour. Our results are in line with the literature on individual motivations in organisations and Open Source business models .

Keywords: Open Source firms, motivations, discrepancy between attitudes and behaviours

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1. Introduction

Since the rise of interest of economists for the Open Source phenomenon, one of the most intriguing questions has dealt with developers' incentives: why Open Source programmers *write, read and revise all that code for free* (Glass, 1999, p. 104)?

A growing body of literature has addressed the issue and many studies have collected empirical data on the motivations of individuals that actively participate in Open Source projects (see for instance Ghosh et al., 2002; Hars and Ou, 2002; Hertel et al., 2003). Feller and Fitzgerald (2002) have added to this literature analysing the incentives of software companies that release the source code of their programs to the Open Source community. They created a comprehensive taxonomy of the motivations to engage in Open Source activities at the individual and organisation level. However, to the best of our knowledge, we are not aware of works that gather data on the incentives of firms that supply Open Source-based products and services to their customers (*Open Source firms*). This paper contributes to the literature by providing empirical evidence on the motivations of these firms to contribute actively to the production of collective goods, allocating private resources. During 2003, we conducted a large-scale survey on Italian firms supplying Open Source solutions. We contacted 275 companies and obtained 146 valid answers. Data refer to 2002 and deal with firms' structural characteristics, business models and attitudes towards the Open Source and its community (Bonaccorsi and Rossi, 2004). A set of questions is included about the motivations that have led these companies to enter the Open Source market, even participating to community projects.

The survey adds to the literature in various ways. On one hand, at present it is the only available piece of evidence about the emergent industry of Open Source producers. On the other hand, in order to establish whether the Open Source is likely to succeed as a sustainable long term production model (Bonaccorsi and Rossi, 2003), we have to examine the supply side, not only individual programmers.

The paper addresses three main research questions.

- (i) Which kind of individual motivations lay at the basis of the entrepreneurial decision to set up an Open Source-based business model?

The psychological literature on motivations distinguishes between intrinsic and extrinsic motivations (Deci, 1975). According to Deci (1971, p.105) *a person is said to be intrinsically motivated to perform an activity when she receives no apparent reward except the activity itself*. Although Fischhoff (1982) states that intrinsic motivations are the primary behavioural motive of human beings (Frey, 1997), however, individuals do not usually act on the basis of intrinsic motivations when they are part of organisations. In this case, their motivations are mainly extrinsic, that is, *induced by the manipulation of rewards and sanctions from outside the agent* (Frey and Benz, 2002, p. 17). Even if individuals, as member of an organisation, share intrinsic motivations, it is likely that their role behaviour is largely determined by the organisational contract, which in turn depends on the performance principle. In short, individuals may be intrinsically motivated in their jobs, but their behaviour ultimately depends on the profit orientation of the organisation they are part of.

This distinction is crucial for addressing a problem neglected in the literature. Why do profit-oriented firms allow their employees to allocate part of their job time to participation in Open Source projects (Hertel et al., 2003)? This amounts to privately contribute to the production of a collective good. Even though individual employed by Open Source firms may have strong intrinsic motivations, it is not obvious why their organisations permit participation to projects. Hence, we hypothesise that intrinsic or, community-based incentives play a less important role as the Open Source evolves from a social to an economic dimension that encompasses the commercial exploitation of the new paradigm.

- (ii) In the event that profit-oriented firms declare to attach importance to intrinsic, community-based motivations, do these attitudes generate consisting behaviour?

Do firms that declare to agree with the values of the Open Source community contribute to projects, maintain social links with individual developers and devote resources to promote the diffusion of Open Source programs? Or rather there is a discrepancy between attitudes and

behaviours? Inconsistency between attitudes and behaviour is a well known phenomenon in social psychology and has been arousing the interest of scholars for a long time (LaPiere, 1934; Wicker, 1969). So that much theoretical and empirical research has been devoted to explain why people do not behave consistently with their attitudes (see for instance Kraus, 1995 for a comprehensive meta-analysis of the empirical findings on the issue).

(iii) Is there a recognizable pattern in discrepancy?

That is, all the firms do not practise what they preach or there are respondents that choose more consistent behaviours? And if yes, what distinguishes these latter from the others?

Exploring discrepancy is important as its existence may impact on the long term sustainability of the Open Source as an original industrial model. Indeed, the larger the discrepancy, the higher the incidence of inconsistent behaviours that may estrange the commercial world from the OS community. The ensuing reduction of the flow of feedback and contributions from developers would threaten the survival of many Open Source firms that provide software services on OS programs. Indeed these service-based business models, which are adopted by most Small and Medium Enterprises, deeply relies on the programming and R&D efforts of the individuals that work within OS projects and makes available updated and reliable software.

The paper is organised as follows.

Section 2 surveys the literature on developers' and firms' motivations in taking part in the Open Source movement.

Section 3 describes data and methodology.

Section 4 explores the discrepancy between attitudes and behaviours of the firms in the sample.

Section 5 summarises the main conclusions of the paper.

2. The motivations of individuals and firms to take part in the Open Source movement. A survey of the literature

Psychological theory on motivations distinguishes between intrinsic and extrinsic incentives. A motivation is extrinsic if needs are satisfied indirectly, especially through monetary

compensation while intrinsic incentives steam from the very pleasure of carrying out an activity (Frey and Osterloh, 1998).

Empirical analyses have highlighted that Open Source developers show both intrinsic and extrinsic motivations (Bitzer et al., 2004). Table 1 summarizes the main programmers' incentives singled out by the literature.

Table 1 - Motivations of Open Source developers

	<i>Motivations</i>	<i>Main references</i>
EXTRINSIC	Monetary rewards	Feller and Fitzgerald (2002), Hertel et al. (2003), Lerner and Tirole (2002b)
	Low opportunity costs	Bonaccorsi and Rossi (2003), Kollock (1999), Lakhani and von Hippel (2003),
	Reputation among peers	Bezroukov (1999), Dalle and David (2004), Lerner and Tirole (2001)
	Future career benefits	Fielding et al. (2002), Lee et al. (2003), Lerner and Tirole (2002a, 2004),
	Learning	Dutta and Prasad (2004), Edwards (2001), Lakhani and von Hippel (2003),
	Contributions from the community	Bonaccorsi and Rossi (2003b), Raymond (2001a), Roberts et al. (2004)
	Technological concerns	David and Pfaff (1998), Pavlicek (2000), Weber (2004)
	Filling an unfilled market	Green (1999), Franke and von Hippel (2003), Feller and Fitzgerald (2002)
INTRINSIC	Creative pleasure (Fun to program)	Green (1999), Torvalds and Diamond (2001), Bates et al. (2004)
	Altruism	Zeitlyn (2003), Raymond (1999), Bergquist and Ljungberg (2001),
	Sense of belonging to the community	David and Pfaff (1998), Raymond (2001b), Crowston and Howison (2004)
	Fight against proprietary software	Moody (2002), Stallman (1984), Ullman (1998)

(i) *The extrinsic motivations of Open Source developers*

First of all, a well-known myth on Open Source movement needs to be reappraised: not all the programmers work for free. Surveying 81 individuals involved in Open Source projects, Hars and Ou (2002) find that 16% respondents receive some *monetary rewards* for their Open Source activities (see also Hertel et al., 2003). Moreover some licence schemes drafted in compliance of the dictates of the Open Source Definition¹ allow to build a commercial operation around the Open Source code (Lerner and Tirole, 2002b). Developers can add new features and functionalities to the code developed within an Open Source project and include them into proprietary solutions.

Anyway, engaging in Open Source projects implies *low opportunity costs* (Kollock, 1999; Kuster et al., 2002; Osterloh et al., 2002). The infrastructure investment for taking part in the movement is extremely low due to the falling in computers' prices and to the widespread

diffusion of the Internet network that makes it possible for software developers to access a very wide audience almost for free. So that posting code on the Web pays off even if the expectations for helpful comments and contributions from the community are relatively low (Kollock, 1999). The main investment for Open Source developers involves time and intellectual resources. With regards to this point, several works have shown that investment in time may be quite limited too. In a study on more than 1,700 individuals taking part to a newsgroup that gives on line help about the Apache Web server, Lakhani and von Hippel (2003) find that over 80% of people providing support spent on average five minutes answering the questions. Indeed, in many case it is easy for programmers to bear their competences to the problem at hand.

Doing this often means benefit from non-direct monetary rewards. Emerging from universities and research centres, the movement has inherited the motivations that lay at the basis of scientific research. The process of scientific discovery provides for the sharing of the knowledge (David, 2004) just as the dictates of the Open Source movement provides for the sharing of the code. Sharing results allows researchers to *gain reputation among peers* and improves their works through feedback from their peers. Likewise, being the Open Source code accessible to everyone, developers' reputation grows with the size of the Open Source community and talented programmers may gain *future career benefits* being noticed by commercial software companies (Lerner and Tirole, 2001, 2002a).

Open Source projects are an immense *learning* opportunity, as programmers study the code written by others and use it for implementing new solutions. The learning incentive explains also why programmers carry on not challenging activities like developing graphical interfaces or writing technical manuals². The achieving of a good knowledge in programming is enhanced by feedbacks and *contributions from the community* that improve software quality and foster bug correction process (Raymond, 2001a). *Technology concerns* do play a role in motivating programmers that have the chance of working with bleeding edge technologies (David and

¹ The Berkley Software Distribution licence (BSD), for instance, allow for the mixability with proprietary licensed products.

Pfaff, 1998). It is claimed that the decentralised production process makes Open Source programs superior to their proprietary equivalents (see for instance Stamelos et al., 2002) particularly when server-side applications are considered.

Filling an unfilled market (Green, 1999; Feller and Fitzgerald, 2002) is another important reason to write Open Source code. Many Open Source projects take shape because people have looked in vain for software performing a particular task³.

(ii) *The intrinsic motivations of Open Source developers*

Empirical findings show that intrinsic motivations are essential in determining the participation of individual programmers in Open Source projects (see for instance David et al., 2003). Many developers often number *fun to program*, *altruism*, *sense of belonging to the Open Source community* and willingness to take part in the *fight for software freedom* among the most important reasons to carry on Open Source activities (Bates et al., 2002; Ghosh et al., 2002; Hars and Our 2002; Lakhani and von Hippel, 2003).

The founding fathers of the movement, who were the very first to address developers' motivations, made mainly reference to a set of hedonistic (*fun to program*) and ego-boosting incentives. Motivations of writing open code are traced back to the values of the *hacker culture* that regards programming as an art form. Open Source production paradigm is a way of recovering the *creative pleasure* that is disappearing within the commercial software framework.

These self-constructing motives couple with intrinsic incentives having a social connotation. *Altruism* lays at the basis of many human behaviours (Monroe, 1996) and even a gift economy exists (Mauss, 1959) that underlines as giving away goods for free is a way for creating and maintaining social links. As scholars claim that the duty of reciprocate holds even if the exchange is not in favour of well-known individuals but of a community of unknown subjects (Godbout et al., 2001), it is easy to draw a parallel and conclude that the community of the Open

² According to Lakhani and Von Hippel (2003) learning from reading the answers to the questions posed by the users is one of the most important motivations for participants to the newsgroups on Open Source programs.

Source hackers is a gift culture (see for instance Zeitlyn, 2003 for a comprehensive discussion on the topic). Programmers hope to have help in future because previous contributions have created a tacit reciprocity agreement while code gifting practises strengthen *programmers' sense of belonging to the community* (collective identification, see for instance Simon et al., 1998 and Akerlof and Kranton, 2000)⁴. Collective identification is enhanced by the presence of an enemy. Hackers are *highly suspicious* of the customerisation of the computer (Ullman, 1998) that, in their opinion, has been favoured by large software companies in general and Microsoft in particular. The *fight against proprietary software* is a strong element of cohesion for the Open Source community (Moody, 2002).

Up to now little attention has been devoted to the motivations behind firms' entrance in the Open Source field (Wichmann, 2002a). The aim at profiting from the new production paradigm shapes the decision to adopt Open Source-based business models. Therefore, the incentives of the Open Source firms are mainly extrinsic. Scholars have claimed that their contingent agreement with the non written norms of the community simply serves the purpose to keep active the cooperative link with developers (Osterloh et al., 2002), not stemming from community-oriented attitudes. The literature has singled out and discussed several incentives (table 2)

Table 2 - Motivations of Open Source firms

	Motivations	Main references
EXTRINSIC	Independence from price and licence policies of large software companies	Lerner and Tirole (2002b)
	Supply of software-related services	Feller and Fitzgerald (2002), Wichmann (2002a), Lerner (2002)
	Indirect revenues by selling related products	Lerner and Tirole (2002a), Wichmann (2002a)
	Exploitation of the R&D activity from the developers' and the other OS firms	Hawkins (2003), Lakhani et al. (2003), Dahlander (2004)
	Software testing by the users' community	Aoki et al. (2001), von Hippel (2002), Fink (2003)
	Availability of good Open Source technicians	Fink (2003), Wichmann (2002b), Lerner (2002), Henkel (2004)
	Lower hardware costs	Feller and Fitzgerald (2002), Tuma (2005)
	Security concerns	Fink (2003)

³ As in the case of the Perl programming Language.

⁴ During an interview with the New York Times, Linus Torvalds declared that making *Linux freely available ...was a natural decision within the community that I felt I wanted to be part of.*

INTRINSIC	Conforming to the values of the OS community (not betraying developers' trust)	Kuster et al. (2002), Lerner and Tirole (2002b)
	Code sharing with the community (reciprocating to sustain cooperation)	Kuster et al. (2002), Egon and Jungwirth (2002)
	Fight for software freedom (to reduce market power of large software companies)	Feller and Fitzgerald (2002)

(iii) *The extrinsic motivations of Open Source firms*

-Intellectual property management. Open Source IPR regimes makes firms *independent from the price and licence policies of large software companies*. Whatever company is allowed to download open code from the Internet and adapt it to meet customers' requirements. No license fee has to be paid and there is no risk of patent or copyright infringement. Notwithstanding that the Open Source framework does not allow to profit from licence fees, it has made particularly viable the business models that are based on service provision. While service offering for proprietary programs (i.e. installation, integration, maintenance or support) forces its providers to pay licence fees to the owner of IPRs on such programs, no fee is due when working with Open Source software. Hence, the *supply of software related services* is a valuable opportunity for the firms that aim at exploiting commercially the code base developed by the OS community even in case of scanty investment capacity.

-Compatibility achievement. Many firms engage in Open Source activities in order to obtain *indirect revenues by selling related products* (see for instance Wichmann, 2002a). This strategy is followed by several large software houses that devote resources to the OS community projects aiming at promoting the sales of their compatible products⁵.

-Knowledge-sharing. The learning aspect that plays a leading role at the micro level is crucial at the organisation level too: code and ideas gathered from Open Source projects are used to develop commercial solutions (Lerner, 2002). Open Source firms not only *exploit contribution the developers' community*⁶ but also benefit from the R&D activity of other companies that download the code from the Internet, adapt it to their needs and eventually place the changes at

⁵ As in case of the decision of IBM to invest on Linux to promote the sales of its e-commerce servers.

⁶ Contributions and feedbacks from the Open Source community lower firms' development costs. It has been calculated (Wheeler, 2003) that Red Hat Linux 7.1, having over 30 million line of code, accounts for 8,000 person-years or 1 billion dollar.

disposal of the community. User community forms a (potentially) very large team of beta testers even though it has been underlined (Franke and Von Hippel, 2003; Von Hippel, 2002) that such an activity is carried on only by few advanced users.

-Innovation and job market. Within OS framework even small firms succeed in contributing to innovation processes that may be pushed forward by the *good IT technicians* working on community projects (Lerner, 2002) that firms can spot for hiring purposes. In his survey on organisations that have adopted Open Source software, Wichmann (2002b) finds out that 21% of the interviewed firms agree about the easier availability of IT specialists in the Open Source framework. In a recent work Prufner (2004) observes that firms contribute to the production process of Open Source Software in order to access to a *qualified network* that gives them competitive advantages in the selection mechanism of highly talented programmers.

Other concerns. Several ancillary expectations may lead firms to enter the OS field. It has been underlined that Open Source software *lowers down hardware costs* (see for instance National Advisory Council on Innovation Open Source Software Working Group, 2002) and addresses very well *security issues*⁷. Finally, it is worth noticing that, at present, Open Source phenomenon is now arousing lively interest in the public opinion. Taking part in the movement may improve the corporate image and strike favourably customers and venture capitalists (Feller and Fitzgerald, 2002).

(iv) *The intrinsic motivations of Open Source firms*

Intrinsic incentives need to be reinterpreted considering the firms' goal of profiting from the Open Source paradigm. According to Osterloh et al. (2002), companies using Open Source code face considerable competitive disadvantages when violating the non written norm of the developers' community. Behaviours such as including pieces open code into proprietary programs or keeping closed parts of the software released to the community⁸ contrast with the

⁷ Moreover firms can carry out Open Source activities in order to pre-empt the development of a standard around a technology owned by a powerful rival (Lerner, 2002).

⁸ Osterloh et al. (2002) cite the case of Netscape that, in 1998, released the code of its web browser Netscape Navigator to the Open Source community. As the software was released only partially and the licence scheme allowed the company to hijack the

rules of the Open Source projects and are likely to bring down the cooperation with individual programmers. This reduces the flow of feedback and contributions from the community to the software in whose production and distribution firms are involved (Kuster et al., 2002). An established pattern of behaviour is as follows. *Breaking of rules is sanctioned by flaming intended to cause shame in the rule-breaker* and then, if *firms are insensitive to shame*, Open Source developers are likely to *stop cooperating or simply migrate to other projects* (Osterloh et al., 2002).

How can a firm follow the norms of the OS community? Its spokesmen may claim to agree with the values of the movement showing their solidarity with the fight for software freedom or providing a concrete support. The very first dictates of the Open Source movement is to keep the code open. Using the OS licences that explicitly forbids code hijacking (*copyleft licenses*, Lerner and Tirole, 2002b) is a credible commitment to it. GLP-like licences are an enforceable mean for binding firms not to include open code in proprietary products and non surprisingly programmers prefer projects which use them. Reciprocation is very important too: cooperating is the best way to sustain cooperation. Several software houses provide financial support and *staff their talented programmers* (Lerner, 2002) to Open Source projects in which they are interested⁹. Firms may even *gift* their code returning those contributed by individuals and actively taking part in the projects. All this enforces the generalised obligation to gift that shape the OS production mode and establishes a virtuous circle of mutual contributions. Indeed firms expect that developers feel bounded by the promise of an endless cooperation.

3. Data and methodology

Data on firms' incentives to enter the Open Source field have been collected by submitting a structured questionnaire to the partners or to the system administrators of Italian Open Source

modifications on the original made by developers, Netscape was unable to attract contributions. The 1.0 version of Mozilla was released only in 2000 when Netscape decided to shift to a GPL-like licence scheme (the Mozilla Public Licence, MPL) trying to win back the trust of the Open Source community.

⁹ Think about IBM and Linux development.

companies¹⁰. We label as *Open Source* the companies that supply, in various ways, Open Source-based products and services to their customers. It is worth noticing that this definition holds even if firm's offering includes also proprietary solutions.

Sample selection was a critical task. Because of the novelty of the phenomenon, there is no complete directory of firms working with the Open Source and new firms are entering the field each year. Specialised journals are publishing lists of these firms but they are partial or restricted to specific business or geographical areas. Hence, we adopted a non-probability sampling procedure called *snowball sampling* in social science (Van Meter, 1990; Frank and Snijders, 1994; Thompson, 2002) where is used to target hidden populations (Salganik and Heckathorn, 2004). We approached an initial short list of companies and asked their collaboration in referring to other firms active in the Open Source field. We stopped the procedure when no new referral was originated and succeeded in contacting 275 firms of which 146 accepted to participate (response rate: 53.1%). Clearly the sample is not statistically representative of the universe but, given the exploratory nature of the study, this was considered methodologically correct.

Given the sampling strategy, we have no information about non-respondents and cannot measure the related bias. During an intensive phone follow-up campaign, however, it was clear that firms strongly committed to Open Source were much more likely to devote time to our research. Under this perspective, among non-respondents there probably were firms that do not actually work with Open Source and were wrongly referred to by other firms, or Open Source firms with somewhat less commitment to the field. At the same time we are aware that survey data are influenced by the national origin. It is difficult to state how important this limitation is, as, to the best of our knowledge, there is no published survey on Open Source firms in other countries or on an international basis. In addition, this survey on Italian firms has been planned as a first exploratory step towards a multi-country study, which will be carried out in 2005 in

¹⁰ We asked for the filling by one of the partners. When this was not possible, as frequently happened for large firms, system administrators has been targeted.

five European countries. In short, our respondents represent an acceptable cross-section of the Italian firms actively operating in the supply-side of the Open Source market.

Table 3 reports descriptive statistics of firms' structural characteristics. Data show that the production of Open Source solutions in Italy is managed mainly by small firms that are born after 1998 (51% of the sample) and have adopted the new paradigm very recently (median age of adoption: 2000, 25° percentile: 1998). They are experiencing a sustained rate of growth (+90% if we take into account only the turnover generated by OSS).

Table 3 - Descriptive statistics of firms' structural characteristics. Note: firms born after 2001 were asked for their Open Source turnover in the last year.

<i>Variable</i>	<i>Unit of Measurement</i>	<i>Min.</i>	<i>Max.</i>	<i>Mean</i>	<i>St. Dev.</i>
Year of foundation	Unit	1957	2003	1996	6.4
Year of Open Source adoption	Unit	1986	2003	1999	2.6
Staff	Unit	1	320	17.3	36.6
Change in turnover (in the last 3 years)	%	-25	600	121.3	155.1

Data on firms' motivations have been collected by a closed – response question made up by eleven items that were selected on the basis of the literature on the incentives to carry on Open Source activities, benefiting also from the extensive field discussions with practitioners during the pilot stage of the questionnaire. Following the psychological literature on the measurement of attitudes and internal states, we use a five – point Likert scale: firms had to assign a score ranging from one (*I totally disagree*) to five (*I totally agree*) to each entry. Table 4 summarises the list of the items, the descriptive statistics of the variables, and the distributions of the scores. The distinction between intrinsic and extrinsic motivations is based on the classification proposed by Lakhani and Wolf (2003) for the incentives of individual developers. Motivations EM1-EM6 pose no problem: they are classified as extrinsic for individual developers, even more so they are extrinsic for firms as they imply cost (EM2, EM4, EM6) or performance advantages (EM1, EM3, EM8). On the contrary, we label as extrinsic reputation gaining (EM7), which the authors regards as intrinsic. Indeed, the community to which a developer feels to belong is formed by Open Source developers and reputation among them contributes to the construction of herself-image (Stevens, 1996) as a talented programmer. Companies, in turn,

face customers and competitors, so that the reputation gained by disclosing valuable code gives rise to competitive advantages.

Lakhani and Wolf (2003) distinguish between *enjoyment-based intrinsic motivations* namely *how creative a person feels when working on Open Source projects* and *community-based intrinsic motivations* dealing with acting consistently *with the norms of a group* (Lindenberg, 2001). The former do not apply to firms as institutions so only the latter are taken into account in this study (IM1-IM3).

Table 4 - Firms' motivations: descriptive statistics and score distributions

	Motivation	Acronym	N	Mean	St. Dev.	Median	Mode	Low score (1,2)	3	High score (4,5)
EXTRINSIC	Open Source software allows small enterprises to afford innovation	EM1	139	4.0	1.2	4	5	12.2	15.8	71.9
	Contributions and feedback from the Open Source community are very useful to fix bugs and improve the software	EM2	141	3.9	1.2	4	5	14.2	17.0	68.8
	Open Source software is reliable and of high quality	EM3	141	3.9	1.2	4	5	16.4	19.3	64.3
	Independence from price and licence policies of the large software companies	EM4	140	3.8	1.2	4	5	12.8	21.3	66.0
	Availability of good IT specialists in the field of Open Source Software	EM5	137	3.4	1.3	3	3	26.6	26.6	46.8
	Studying the code written by other programmers and using it to develop new programs and solutions	EM6	139	3.3	1.3	3	3	27.0	26.3	46.7
	Gaining a reputation among costumers and competitors by opening the source code	EM7	141	3.1	1.2	3	3	32.6	27.7	39.7
	Having products not available on the proprietary software market	EM8	139	3.0	1.4	3	3	36.0	25.9	38.1
INTRINSIC	Agreement with the values of the Open Source movement	IM1	140	3.8	1.3	4	5	17.9	17.8	64.3
	Placing source code and skills at disposal of the Open Source community	IM2	141	3.4	1.3	4	4	24.8	24.8	50.4
	Thinking that software should not to be a proprietary assets	IM3	135	3.0	1.4	3	2	40.7	19.3	40.0

Score distributions are concentrated and their mean values are very similar among each other, ranging from 4.0 to 3.0. For all the items but IM3, the percentage of high scores (4 or 5) is considerably higher than the percentage of low scores (1 or 2). This is referable to several causes. First, during the phone interviews people showed great accordance with the proposed list of the items. Second, the *acquiring* and *interviewer effects* are highly severe in phone surveys (Groves et al., 2004) as interviewee is inclined to choose the answers which, according her evaluations, make a good impression on the interviewer (willingness to look as a *good subject*). In our case the respondents might have thought that the interviewer would have preferred high scores and that such a choice would have made them to look skilled in Open Source issues. Third, data are likely to be affected by the *mid-point category bias* (Garland,

1990). That is, subjects might have chosen the score 3 when they did not understand the question, or wanted to minimize their cognitive effort.

Despite these caveats, some interesting findings emerge which corroborate the theoretical hypotheses on firms' incentives to take part in the Open Source movement (Feller and Fitzgerald, 2002). As expected, extrinsic motivations do play a leading role. When items are ranked by the mean of the scores or by the percentage of high scores, incentives that fit well the decision processes of profit-oriented firms rank first (table 4). The propositions dealing with the promotion of innovation by small enterprises, the saving in developing and license costs, and the high quality of the OS software show the highest level of accordance. It is worth noticing that above 42% of the firms *totally agree* upon proposition EM1 that shows also the highest percentage of high scores (71.9%) and the lowest percentage of low scores (12.2%)¹¹.

Data on intrinsic motivations are twofold. Firms declare to agree with the values of the Open Source community (IM1: 64.5% of high scores and 17.9% of low scores) but the item dealing with the fight for software freedom (IM3) ranks at the bottom of the list while the one concerning code gifting behaviours is below the average (IM2). These results get into line with the literature regarding firms' social motivations as extrinsic (Osterloh et al., 2002) simply serving the purpose of keeping active the cooperative link with individual developers. To further uphold this hypothesis, we compare data on incentives with data on firms' involvement in community activities and check for discrepancies between attitudes (a high level of accordance with community-oriented motivations) and behaviours (the actual participation in Open Source).

4. Discrepancy between attitudes and behaviours in Open Source firms

The existence of a discrepancy between firms' attitudes and behaviours is tested referring to the following metrics of involvement in Open Source activities

¹¹ M4 displays also the lowest frequency of the value 3..

- (i) *Social links with the community*, as measured by the number of developers with whom the company has social contacts, by the frequency of these contacts, and by the level of reliability attached to the information received
- (ii) *Involvement in Open Source plug activities*, including having an entry in the budget for Open Source advertising and promotion
- (iii) *Participation in Open Source projects*, as measured by the number of projects joined and coordinated¹², by the percentage of lines of code (LOCs) contributed and by the number of patches and modules accepted in the project official versions

Table 5 and 6 report the list of the variables. The former refers to the variables measured on nominal scales (group A) while the latter refers to those measured on ordinal or ratio scales (group B).

Table 5 - Firms' involvement in Open Source activities, binary and ordinal variables

<i>Variables – Group A</i>	<i>Unit of measurement</i>	<i>No.</i>	<i>Never</i>	<i>Daily</i>	<i>Weekly</i>	<i>Monthly</i>	<i>Less than Monthly</i>	<i>% of true</i>	<i>% of false</i>
SOCIAL LINKS WITH THE COMMUNITY								-	-
Frequency of the contact with the Open Source community	Nominal variable	105	25.7	36.2	12.4	16.2	9.5	-	-
INVOLVEMENT IN OS PLUG ACTIVITIES								-	-
Open Source Software plug activities	Nominal variable (true/false)	135	-	-	-	-	-	73.3	26.7
Entry of the budget devoted to Open Source plug activities	Nominal variable: (true/false)	121	-	-	-	-	-	27.3	72.7

Table 6 - Firms' involvement in Open Source activities, ratio scale variables

<i>Variable – Group B</i>	<i>Unit of measurement</i>	<i>No.</i>	<i>Min</i>	<i>Max</i>	<i>Mean</i>	<i>Std. Dev.</i>	<i>Percentiles</i>			
							<i>50</i>	<i>75</i>	<i>90</i>	<i>95</i>
SOCIAL LINKS WITH THE OS COMMUNITY										
No. of OS community members the firm has social contacts with	Unit	83	0	100	2.0	10.2	3.0	10.0	76.0	100.0
Reliability attached to the information received by OS community members	5-point Likert scale	76	2	5	4.1	0.8	4.0	5.0	5.0	5.0
INVOLVEMENT IN OS PLUG ACTIVITIES										
Time devoted to OS plug activities	Unit	112	0	500	42.6	84.5	20.0	37.5	100.0	217.5
PARTICIPATION IN OS PROJECTS										
No. of projects joined since the very start of their Open Source activity	Unit	117	0	50	3.8	7.8	1.0	4.0	10.0	25.5
No. of projects joined in 2002	Unit	118	0	20	1.6	2.8	1.0	2.0	4.0	6.0
No. of projects coordinated since the very start of their Open Source activity	Unit	123	0	28	1.1	3.4	0.0	1.0	3.0	5.1

¹² Both as in 2002 and from the very start of the Open Source activities

No. of projects coordinated during 2002	Unit	121	0	7	0.5	1.2	0.0	0.0	1.8	3.9
Percentage of LOCs contributed to each project on average	%	104	0	99	10.6	23.5	0.0	5.0	50.0	80.0
Contributions incorporated in project official versions	Unit	99	0	300	6.9	36.9	0.0	1.0	5.0	10.0

Data show that firms in the sample carry on community-oriented activities only to a limited extent. About 40% of the respondents have daily contacts with Open Source developers but more than 25% have never had any interaction. Respondents state that the information received from the community are highly reliable but the number of social links is low. Notwithstanding that firms claim to promote Open Source products (devoting on average 42.6 working days per year to this activity) most of them have no corresponding entry in the budget.

The scanty involvement with the community is reaffirmed by firms' activity within projects. It seem that firms deal basically with the mere adaptation of Open Source programs to meet customers' requirements (*firms as code takers*) while little importance is attached to circulate these solutions back to the community (*firms as code givers*). On average, firms joined fewer than 4 projects since taking their first steps in the Open Source field, 46.2% have never take part in a project and about 68% have been engaged in no more than 2 ones; almost half of the sample (49.6%) is not currently participating. Things go even worse as far as coordination is concerned. Most respondents (72.9%) have never coordinated a project, only 26 firms (21.5%) are currently coordinating and the majority of these just one project. Firms' programming effort is limited too: 60% of the firms contribute no LOCs and only 10.6% contribute more than 50% of LOCs. Few firms (26.3%) have pieces of code accepted for projects' official versions.

These findings are at odds with the general agreement with the values of Open Source community declared in the question on incentives. The discrepancy between attitudes and behaviours is clear-cut. Firms that have chosen high (4 or 5), medium (3) and low (1 or 2) scores for proposition IM1 are compared. As summarised in table 7, all the behavioural variables in group B but the *time devoted to Open Source plug activities* and *contributions incorporated in project official versions* show no significant differences in the mean values in

the three groups. Similar results are obtained by running Chi Square Tests (table 8) for nominal variables.

Table 7 – Discrepancy between attitudes and behaviours, Kruskal Wallis Test for mean differences. Note.*: p value < 0.10; ***: p value< 0.01.

Variables	LOW SCORES (1 or 2)			MEDIUM SCORE (3)			HIGH SCORES (4 or 5)			Kruskal Wallis Test – P value
	No.	Mean	Std. Dev.	No.	Mean	Std. Dev.	No.	Mean	Std. Dev.	
No. of community members the firms has social contacts with	12	14.8	29.1	13	11.1	27.4	56	23.4	53.8	0.281
Reliability attached to the information received by community members	8	3.8	0.7	11	4.2	0.8	55	4.1	0.8	0.447
Time devoted to OS plug activities***	18	7.2	13.5	21	22.7	31.3	71	58.6	101.3	0.001
No. of projects joined since the very start of their OS activity	19	3.7	7.4	21	4.0	8.8	75	3.8	7.9	0.695
No. of projects joined in 2002	18	1.6	2.3	24	1.0	1.4	79	1.8	3.2	0.566
No. of projects coordinated since the very start of their OS activity	18	1.4	4.8	22	2.0	6.1	76	0.7	1.5	0.625
No. of projects coordinated during 2002	18	0.6	1.7	24	0.6	1.4	77	0.4	1.1	0.847
Percentage of LOCs contributed to each project on average	17	6.6	16.4	19	4.8	9.6	67	12.1	26.0	0.473
Contributions incorporated in project official versions*	14	0.2	0.6	17	0.0	0.0	67	2.9	12.4	0.008

Table 8- Discrepancy between attitudes and behaviours, Chi Square Tests. Note.**: p value < 0.5; ***: p value< 0.01.

Variable		LOW SCORES (1 or 2) %	MEDIUM SCORE (3) %	HIGH SCORES (4 or 5) %	Chi Square Test P value
Open Source plug activities*	False	45.8	37.5	17.6	0.008
	True	54.2	62.5	82.4	
Entry of the budget devoted to OS plug activities***	False	95.2	86.4	61.8	0.003
	True	4.8	13.6	31.2	
Frequency of the contact with the Open Source community	Never	21.1	33.3	42.9	0.514
	Daily	39.4	27.8	21.4	
	Weekly	15.5	5.6	7.1	
	Monthly	16.9	16.7	14.3	
	Less than monthly	7.0	16.7	14.3	

As things are, two research questions are of interest

- (i) Is discrepancy between attitudes and behaviour a generalized pattern or is it possible to single out groups that act more consistently with their community-based incentives?
- (ii) If yes, do these firms share peculiar characteristics?

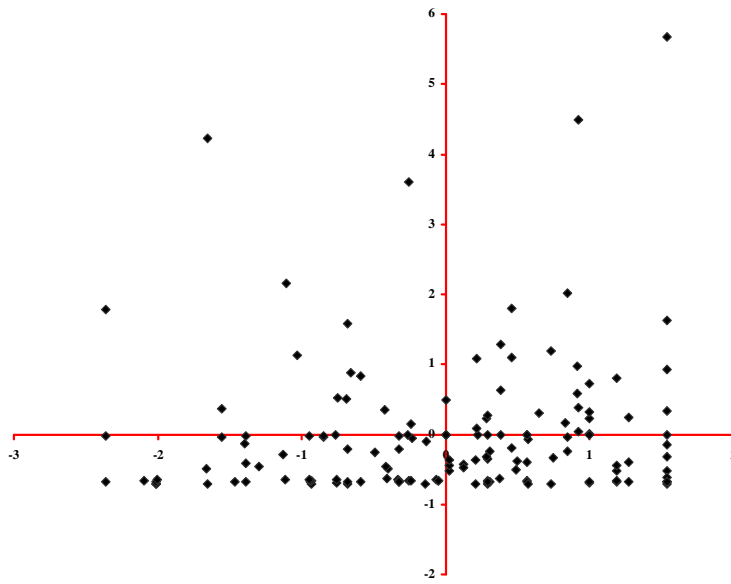
To evaluate discrepancy vs. concordance between attitudes and behaviours in different groups of respondents, synthetic measures have been calculated by running principal component analyses (PCA)¹³.

¹³ Missing data have been replaced by mean values in order to exploit the whole dataset.

To avoid differences in the measurement scales, only group B variables but *Reliability attached to the information received by community members* are included in the PCA that extracts behavioural dimensions¹⁴. Three components are extracted from the data but only the first component shows positive correlations with all the behaviour variables and they are significantly higher for the dimensions dealing with project participation (see table A2 in the Appendix). As contributions to the collective production of open code is a crucial indicator of the involvement in Open Source activities, this component (B) turns out to be a valid metric for firms community oriented behaviours. A companion metric for firms' attitudes is obtained by running PCA on the variables dealing with intrinsic motivations (IM1, IM2, IM3). Only one component is extracted from the data (IM) which is high correlated with all the intrinsic incentives (see table A3 in the Appendix). The Pearson Correlation Index between IM and B is not significantly different from zero (0.096, p value = 0.249) corroborating that, in general, the agreement with the Open Source community values does not give rise to consistent behaviours. Plotting the scatter diagram that positions each firm in a Cartesian plan on the basis of the values of IM (x-axis) and B (y-axis), four different cases come to evidence (figure 1).

Figure 1 - Motivational and behavioural dimension, scatter plot

¹⁴ It worth noticing that the procedure does not suffer from information loss as variables in group A target the same aspects (contact and Open Source plug activities) than variables in group B.



Firms in quadrant¹⁵

- I (27, 18.5%) show positive values for both the dimensions, they declare strong intrinsic motivations and act in a consistent manner (*Community-Oriented Firms, COF*)
- II (13, 8.9%) show positive values for the behavioural dimension but negative values for the motivational one, they behave inconsistently with their attitudes but in an unexpected way. They declare weak community oriented attitudes but contribute to the production and diffusion of Open Source Software (*Incognito Community Oriented Firms, ICOF*)
- III (50, 34.2%) show negative values for both the dimensions, they have low intrinsic motivations and act in a consistent manner (*Non Community Oriented Firms, NCOF*)
- IV (45, 30.8%) show positive values for the motivational dimension and negative values for the behavioural one, these firms do to practise what they preach (*Opportunistic Firms, OF*).

NCOF form the largest group and pose no interpretation problem. As profit-oriented organisations, they entered the Open Source field prompted by the prospect of cost and competitive advantages. They seize the commercial opportunities of the new paradigm by exploiting of the collective developed software without taking part actively in its production

process (*firms as takers*). The percentage of the non-users of the GLP license is significantly higher in this group than in the rest of the sample (27.1% vs. 8.8%, Chi Square Test, p value= 0.06). Notwithstanding that most respondents (66.0%) declare to attach high strategic importance to Open Source, 57.1% offer indifferently open and proprietary solutions¹⁶ (vs. 33.3% of the other firms, Chi Square Test, p value = 0.10).

Few firms are ICOF, so the empirical evidence on this group are poorly informative. Anyway it is worth noticing that 10 out 13 (76.9%) assign high score to EM2, that is the large majority think that *contributions and feedback from the Open Source community are very useful to fix bugs and improve the software*. This may indicate that, as in the Osterloh's hypothesis, their community-oriented behaviours are aimed at keeping active the link with individual programmers. Anyway the group is consistent with its profit-oriented nature and assigns low scores to intrinsic incentives, 75% assign low scores (1 or 2) to IM3 and none totally agree with this proposition.

Community-Oriented and Opportunistic Firms are clearly the most intriguing groups. *COF* have strong community-oriented attitudes¹⁷ and behave consistently with them. In general, *COF* have adopted the new paradigm from the very start (early adopters: 88.9% vs. 59.3%, Chi Square Test, p value=0.04). They all have joined at least one OS project and have social contacts with individual developers. The large majority have carried on coordination tasks and perform Open Source plug in activities for which there is an entry budget in almost half on the cases (see table 9). Surprising no significant difference emerges as far as the use of the GPL is concerned but all the respondents state to attach high strategic importance to the Open Source that in 92.6% of the cases is the most important offering.

Table 9 – COF's behaviours, Chi Square Tests. Note.**: p value < 0.5; ***: p value< 0.01.

Variable	COF	Other firms	Chi Square Test P value
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¹⁵ Eleven firms (7.5%) show at least one zero value in the two components as a consequence they are not included in the analysis.

¹⁶ Firms were asked about the typology of solutions provided to their customers. Closed response question, options: exclusively Open Source solution; mainly Open Source solutions; indifferently Proprietary and Open Source solutions

¹⁷ None of the COF assign low scores to IM1 while the percentage of high scores is 96.3. No low score also for IM2 (88.9% of high scores) while less than 20% assign 1 or 2 to IM3 (55.5% of low scores).

% of firms that have joined at least one Open Source project***	100	40.7	0.000
% of firms that have coordinated at least one Open Source project***	76.0	13.0	0.000
% of firms that have social contacts with the Open Source developers ***	100	59.7	0.000
% of firms that carry on Open Source plug activities**	92.6	67.9	0.003
% of firms in whose budget there is an entry devoted to OS plug activities**	48.1	20.9	0.005

Findings on OF firms corroborate the hypothesis on the extrinsic nature of firms' community-based motivations. OF declare to agree with the values of the Open Source community (average score of IM1: 4.5 vs. 3.4 of the other firms, p value=0.000) but their contributions in projects are scanty (table 10). No difference emerges as far as the exclusive use of the GLP is concerned (but only 3 OF respondents do not use this license) and in half of the cases proprietary and Open Source solutions are indifferently provided to the customers. The agreement with the values of the Open Source community seems then only nominal without being put into practise.

Table 10– OF's behaviours, Chi Square Tests. Note. * p value < 0.1; **: p value < 0.5; ***: p value < 0.01.

Variable	OF	Other firms	Chi Square Test P value
% of firms that have joined at least one Open Source project*	41.0	59.7	0.056
% of firms that have coordinated at least one Open Source project***	7.5	36.4	0.001
% of firms that have social contacts with the Open Source developers **	55.9	76.5	0.046
% of firms that carry on Open Source plug activities	72.7	73.9	0.889
% of firms in whose budget there is an entry devoted to OS plug activities**	37.8	22.2	0.077

We discuss two hypotheses dealing with the characteristics of the firms in the four groups

- *Hypothesis I: firms whose promoting partners have been previously involved in Open Source activities on an individual basis are more likely to show community-based attitudes and to behave consistently with them.*

According to this hypothesis, community-oriented attitudes and behaviours at a firm level have been inherited from partners who took part previously in Open Source projects as individual developers and then joined together to turn a passion into a profession. The questionnaire did not collected data on OS programming of the founders so a proxy for it is needed. We use a dummy variable (D) that assumes value 1 if the firm's partners had all a technical background or founded the company just to work with Open Source, and value 0 otherwise. An entrepreneurial core formed only by technicians is more likely to be the outcome of the decision

of a group of individual developers to enter the software market by exploiting their OS skills. Likewise, firms born just to work with Open Source software are probably the result of a similar entry strategy as partners with financial or economic backgrounds might have been involved to provide managerial competences. Thus, given the exploratory nature of this study, D is considered an acceptable operationalisation of the concept discriminating firms that are more likely to be founded by Open Source developers (D=1) from the others (D=0).

To test hypothesis I we tabulate D for each group of the firms and find out that it assumes value 1 for at least 80% of the COF. Percentages are significantly lower in the other groups (38.5%, 38.0%, 55.6% respectively, Chi Square Test, p value=0.006)¹⁸. Findings on group IV are of interest. The fact that almost 60% of the *Opportunistic Firms* are likely to be founded by individual programmers may indicate a better knowledge on the social dynamics within the Open Source community which may have lead firms to express community-oriented attitudes also without the corresponding behaviours. COF and OF account for the 65.7% of the whole firms with D=1.

We can reasonably conclude that the social dimension of the Open Source movement has a chance to survive to its evolution into an economic reality through individual developers that transfer their hacker culture to Open Source companies.

- *Hypothesis II: Firms' attitudes and behaviours depends on the strength of the commitment in the new paradigm. Companies with a strong commitment are likely show positive attitudes towards the community and a consistent behaviour (COF) but firms with a weak commitment may show both negative attitudes/consistent behaviour (NCOF) or positive attitudes/discrepant behaviours (OF)*

Firms with a weak commitment are likely not adopt community-oriented behaviours as their involvement in the field is scanty and based mainly on the adaptation of OS programs to meet customers' requirements. Anyway even these firms may want to keep active the link with the

¹⁸ If all the respondents are taken into account, 77.8% of the COF have D=1 vs. 45.6% of the other firms (Chi Square Tests, p value= 0.03).

community as it might turn out to be useful independently on the focus on OS of the business model. First, independently on their size, firms' Open Source activities might depend strongly on contributions and feedback from the community. Companies mainly focused on proprietary solutions are likely to suffer from shortage of Open Source skills and need the help of individual developers. Second, it worth noticing that customers that choose Open Source software have often strong intrinsic motivations thinking of open standards as a way of contrasting the monopoly power of large software companies. As a consequence the blame of firms that work on proprietary field is put not only by the OS community (see for instance O'Mahony and West, 2004, 2005) but also by individual users (Rogers, 2000).

In a companion paper (Bonaccorsi et al., 2004) we have proposed a classification of the respondents in the sample on the basis of their commitment in the Open Source paradigm (More Open Source Oriented, MOSS, vs. Less Open Source Oriented, LOSS). 74 firms have been labelled as MOSS, 64 as LOSS while 8 has considered *Pure Open Source Firms (POSF)* having a business model entirely based on the provision of open solutions (the classification procedure is extensively described in the paper).

Findings in table 11 corroborates hypothesis II. The contingency table shows that in the COF group only 1 firm out of 27 is LOSS, 20 are MOSS while 6 are *Pure Open Source firms*. A similar distribution hold for ICOF while more than half of the NCOF and OF firms are LOSS. These latter account for the 92.5% of the Less Open Source Oriented firms (table 11).

Table 11: MOSS and LOSS firms distribution

BUSINESS MODEL (BM)			GROUP					Chi Square Test p value
			COF	ICOF	NCOF	OF	Total	
	LOSS	N	1	3	26	23	53	0.000
		% within BM	1,9	5,7	49,1	43,4	100,0	
		% within GROUP	3,7	23,1	52,0	51,1	39,3	
	MOSS	N	20	9	24	21	74	
		% within BM	27,0	12,2	32,4	28,4	100,0	
		% within GROUP	74,1	69,2	48,0	46,7	54,8	
	POSF	N	6	1		1	8	
		% within BM	75,0	12,5		12,5	100,0	
% within GROUP		22,2	7,7		2,2	5,9		
Total	N	27	13	50	45	135		
	% within BM	20,0	9,6	37,0	33,3	100,0		
	% within GROUP	100,0	100,0	100,0	100,0	100,0		

It is now of interest to study whether the 23 LOSS firms in the OF group suffer from a shortage of Open Source skills or serve customers with strong preferences for Open Source software. With respect to the other LOSS firms, the 23 OF respondents assign higher scores to proposition EM5 dealing with the availability of good IT specialist in Open Source software (average score: 3.7 vs. 3.0, Mann-Whitney Test, p value=0.035) and proposition EM6 dealing with the learning opportunities given by the new paradigm (average score: 3.6 vs. 2.8, Mann-Whitney Test, p value=0.044). No significant difference emerge as far as consumers' attitudes are concerned. Anyway, comprehensive conclusions are far to be reached. Setting aside the small size of the considered sub-samples, further investigations are needed also to find better proxies for firms' shortage in Open Source skills and customers' attitudes towards Open Source software.

5. Conclusions

This paper adds to the literature by providing empirical evidence on the motivations of the software companies that enter the Open Source field aiming at profiting from the new paradigm. Using data collected by a large-scale survey on 146 Italian Open Source firms, we find out that, surprisingly, extrinsic, profit-oriented incentives couple with intrinsic, community-based motivations. Anyway, in most cases these positive attitudes are not put into practise and the very participation to the Open Source community is scanty. This discrepancy between attitudes and behaviours corroborates the hypothesis of Osterloh et al. (2002) on the extrinsic nature of firms' intrinsic motivations. The authors claim that, in case of firms, declaring community-based incentives simply serves the purpose of winning the trust of individual developers for receiving contributions and support from them and gaining competitive and cost advantages. After grouping the respondents on the basis of the extension of the discrepancy, two hypotheses are discussed. First, we suggest that the sub-group of firms that adopt a consistent behaviour have probably inherited their community oriented attitudes from founders that were previously involved in OS programming at the individual level and have turned their passion into a

profession. In short, the economic importance of Open Source is now growing but its social connotation survives via the transposition of the hacker culture into the Open Source firms.

Second, we show that the relation between attitudes and behaviour clearly depends on the strength of firms' commitment on Open Source software but even companies with a business model mainly based on proprietary solutions may find convenient to express community oriented attitudes.

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APPENDIX

Table A1: Correlation matrix (ratio scale variables in group B). Note- **: correlation is significant at the 0.01 level (2-tailed), * correlation is significant at the 0.05 level (2-tailed).

		1		2		3		4		5		6		7		8
1	No. of projects joined since the very start of their Open Source activity	1,000		0,571	**	0,500	**	0,459	**	0,151		0,372	**	0,221	**	0,025
2	No. of projects joined in 2002	0,571	**	1,000		0,326	**	0,550	**	0,377	**	0,672	**	0,150		0,112
3	No. of projects coordinated since the very start of their Open Source activity	0,500	**	0,326	**	1,000		0,663	**	0,203	*	0,040		0,107		0,058
4	No. of projects coordinated during 2002	0,459	**	0,550	**	0,663	**	1,000		0,334	**	0,078		-0,033		0,116
5	Percentage of LOCs contributed to each project on average	0,151		0,377	**	0,203	*	0,334	**	1,000		0,276	**	-0,001		0,086
6	Contributions incorporated in project official versions	0,372	**	0,672	**	0,040		0,078		0,276	**	1,000		0,078		0,035
7	No. of community members the firms has social contacts with	0,221	**	0,150		0,107		-0,033		-0,001		0,078		1,000		0,038
8	Time devoted to OS plug activities	0,025		0,112		0,058		0,116		0,086		0,035		0,038		1,000

Table A2 - Behavioural variables: component matrix

<i>Variables</i>	<i>Components</i>		
	<i>1</i>	<i>2</i>	
No. of community members the firms has social contacts with	0.763	-0.015	0.330
Time devoted to OS plug activities***	0.856	0.322	-0.062
No. of projects joined since the very start of their Open Source activity	0.669	-0.584	0.148
No. of projects joined in 2002	0.756	-0.493	-0.146
No. of projects coordinated since the very start of their Open Source activity	0.505	0.118	-0.491
No. of projects coordinated during 2002	0.561	0.726	-0.095
Percentage of LOCs contributed to each project on average	0.200	0.198	0.780
Contributions incorporated in project official versions	0.158	-0.045	-0.269

Component Matrix

Table A3 – Motivational variables: component matrix

<i>Variables</i>	<i>Component 1</i>
Agreement with the values of the Open Source movement	.853
Placing source code and skills at disposal of the Open Source community	.825
Thinking that software should not to be a proprietary assets	.699