Why profit-oriented companies enter the OS field?
Intrinsic vs. extrinsic incentives

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ABSTRACT

This paper contributes to the literature on Open Source (OS) by providing empirical evidence on the incentives of firms that engage in the field. Data collected by a survey on 146 Italian companies supplying OS solutions (*Open Source firms*) show that (surprisingly) intrinsic, community-based incentives do play a role but are not, in general, put into practise. We investigate this discrepancy between attitudes and behaviours and single out groups of firms adopting a more consistent behaviour. Our results are in line with the literature on individual motivations in the OS movement.

Categories and Subject Descriptors

K.6.1. [**Management of Computing and Information system**]: Project and People Management

General Terms

Management, Economics, Human Factors

Keywords

Open Source firms, motivations, attitudes, behaviours

INTRODUCTION

Since the rise of interest of scholars for the Open Source phenomenon, one of the most intriguing questions has dealt with developers' incentives. 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 OS projects (table 1). Psychological theory 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 on an activity. Empirical analyses have highlighted that OS developers show both intrinsic and extrinsic motivations.

Extrinsic motivations deal in particular with being paid for OS developing; gaining reputation as talented programmers (thus obtaining future career benefits); learning by studying the code written by others; and benefiting from contributions from the community. Moreover many developers 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 programming.

Table 1 - Motivations of Open Source developers

	Motivations of Open Source developers	Main references
EXTRINSIC	Low opportunity costs	[1]
	Monetary rewards	[2], [3], [4]
	Reputation among peers	[5], [6]
	Future career benefits	[7]
	Learning	[8]
	Contributions from the community	[9]
	Technological concerns	[10]
	Filling an unfilled market	[2]
INT.	Creative pleasure (Fun to program)	[11], [12]
	Altruism	[13], [14]
	Sense of belonging to the community	[15]
	Fight against proprietary software	[16]

Feller and Fitzgerald [2] have added to the OS literature analysing the incentives of software companies that engage in OS activities. The aim at profiting shapes the decision to adopt Open Source-based business models (table 2) while it has been claimed that contingent agreement with the non written norms of the OS community simply serves the purpose to keep active the cooperative link with developers Indeed, behaviours violating community rules may bring down individual developers' cooperation.

This paper contributes to the literature by providing empirical evidence on the firms that supply OS-based products and services (Open Source firms). To the best of our knowledge, we are not aware of works that gather data on these firms. Three main research questions are addressed: (i) Which motivations lay at the basis of the entrepreneurial decision to set up an Open Source-based business model? Even if individuals employed by OS firms may be intrinsic motivated in their jobs, their behaviour ultimately depends on the profit orientation of the organisation they are part of. Hence, firms' incentives cannot been regarded simply as the sum of individuals' one. As things are, why do firms allow their employees to allocate part of their job time to the production of a collective good?

Table 2 - Motivations of Open Source firms

	Motivations	Main references
EXTRINSIC	Independence from price and licence policies of large software companies	[4]
	Supply of software-related services	[2], [17]
	Indirect revenues by selling related products	[18], [17]
	Exploitation of the R&D activity from the developers' and the other OS firms	[19], [20]
	Software testing by the users' community	[21], [22]
	Availability of good Open Source technicians	[22], [23]
	Lower hardware costs	[2]
	Security concerns	[22]
INT.	Conforming to the values of the OS community (not betraying developers' trust)	[24], [4]
	Code sharing with the community (reciprocating to sustain cooperation)	[24]
	Fight for software freedom (reducing market power of large software companies)	[2]

(ii) In the event that profit-oriented firms declare to attach importance to intrinsic, community-based motivations, do these attitudes generate consisting behaviours? (iii) If attitudes do not generate consistent behaviours, is there a recognizable pattern in discrepancy? Are there respondents that adopt consistent behaviours? And if yes, what distinguishes these latter from the others? Exploring discrepancy is important because it may impact on the long term sustainability of the Open Source as an original industrial model. Indeed, the larger the discrepancy, the higher the risk that the companies are estranged from the OS community. The ensuing reduction of contributions from developers might threaten their survival.

INTRINSIC AND EXTRINSIC MOTIVATIN IN THE OS MOVEMENT

Data have been collected by submitting a structured questionnaire to the partners or the system administrators of more than 250 Italian Open Source companies obtaining 146 valid answers (see [25] for the sample selection details). Data show that the offering of OS solutions in Italy is managed mainly by small companies that are born after 1998 (51% of the sample) and have adopted the new paradigm only recently (table 3).

Table 3 - Descriptive statistics of firms' characteristics.

Variable	Unit of Measurement	Min.	Max.	Mean	St. Dev.
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

Incentives are measured through a 5–point Likert scale. Firms had to give a mark from 1 (*I totally disagree*) to 5 (*I totally agree*) to 11 items selected according to the literature. Basing on [26], we distinguish between intrinsic (IM) and extrinsic (EM) motivations.

Our findings corroborate theoretical hypotheses. As expected, extrinsic motivations do play a role. When items are ranked by the mean of the scores, incentives that fit well the decision processes of profit-oriented firms rank first (table 4). Results on intrinsic motivations are twofold. Firms declare to agree with the values of the community (IM1) but the item dealing with the fight for software freedom (IM3) ranks at the bottom of the list while the one concerning code gifting is below the average (IM2). This gets into line with the literature regarding firms' social motivations as simply serving the purpose of sustaining cooperation with developers. To further corroborate 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 values) and behaviours (the actual participation in Open Source activities).

Table 4 - Firms' motivations: descriptive statistics

	Motivation	Acro nym	N	Mean	St. Dev.	Med.	Mode	Low score (1,2)	3	High score (4,5)
EM	Open Source software allows small enterprises to afford innovation	EM1	139	4.0	1.2	4	5	12.2	15.8	71.9
	Contributions from the OS community are useful to fix bugs and improve 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 (using it for new 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 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
IM	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

DISCREPANCY BEETWEEN ATTIDUTES AND BEHAVIOURS

Discrepancy between firms' attitudes and behaviours is tested referring to several metrics of involvement in Open Source activities dealing with *social links with the community, involvement in OS advertising activities*, *participation in OS projects* (table 5).

Table 5 - Firms' involvement in OS activities (ratio scale)

Variables	Unit of measurement	No.	Min	Max	Mean	Std. Dev.	50	75	90	95
SOCIAL LINKS WITH THE OS COMMUNITY										
OS developers 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 them	Likert scale	76	2	5	4.1	0.8	4.0	5.0	5.0	5.0
INVOLVEMENT IN OS ADVERTISING ACTIVITIES										
Time devoted to OS advertising activities	Working days	112	0	500	42.6	84.5	20.0	37.5	100.0	217.5
PARTICIPATION IN OS PROJECTS										
Projects joined since the very start of the OS activity	Unit	117	0	50	3.8	7.8	1.0	4.0	10.0	25.5
Projects joined in 2002	Unit	118	0	20	1.6	2.8	1.0	2.0	4.0	6.0
Projects coordinated since the very start of the OS activity	Unit	123	0	28	1.1	3.4	0.0	1.0	3.0	5.1
Projects coordinated during 2002	Unit	121	0	7	0.5	1.2	0.0	0.0	1.8	3.9
Percentage of LOCs contributed on average to each project	%	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, especially as far as projects' participation is concerned. It seem that companies basically adapt OS 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*).

These findings are at odds with the agreement with the values of OS community declared in the question on incentives: 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. All the examined behavioural variables but the *time devoted to Open Source advertising activities* show no significant differences in the mean values in the three groups (table 6, K.W.=Kruskal Wallis Test).

Table 6 – Discrepancy between attitudes and behaviours.
Note.*: p value < 0.10; ***: p value< 0.01.

Variables	LOW SCORES (1 or 2)			MEDIUM SCORE (3)			HIGH SCORES (4 or 5)			K.W. – P value
	No.	Mean	Std. Dev.	No.	Mean	Std. Dev.	No.	Mean	St. Dev.	
OS developers the firm 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 them	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
Projects joined since the very start of the OS activity	19	3.7	7.4	21	4.0	8.8	75	3.8	7.9	0.695
Projects joined in 2002	18	1.6	2.3	24	1.0	1.4	79	1.8	3.2	0.566
Projects coordinated since the very start of the OS activity	18	1.4	4.8	22	2.0	6.1	76	0.7	1.5	0.625
Projects coordinated during 2002	18	0.6	1.7	24	0.6	1.4	77	0.4	1.1	0.847
% 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

It is now of interest to find out weather discrepancy is a generalized pattern or there are respondents acting consistently with their attitudes. If yes, do these firms share peculiar characteristics? Synthetic measures for attitudes and behaviours have been calculated by running principal component analyses (PCA). Three components are extracted for the behavioural dimension but only the first one shows positive correlations with all the behavioural variables. Hence this component (B) turns out to be a valid metric for firms' activities within the OS community. A companion metric for firms' attitudes is obtained by running PCA on the variables dealing with intrinsic motivations (IM1, IM2, and IM3). Only one component is extracted from the data (IM) which is high correlated with all the intrinsic incentives. 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 OS community values does not give rise to consistent behaviours. Four groups of firms come to evidence

1. *Non Community Oriented Firms* (50, 34.2%): negative values for both the dimensions. They have low intrinsic motivations and act in a consistent manner

2. *Incognito Community Oriented Firms* (13, 8.9%): positive values for B but negative values for IM. They behave inconsistently with their attitudes but in an unexpected way

3. *Community-Oriented Firms* (27, 18.5%): positive values for both the dimensions. They declare strong intrinsic motivations and act in a consistent manner

4. *Opportunistic Firms* (45, 30.8%) positive values for the IM and negative values for B. They do to practise what they preach.

The first group poses no problem. As profit-oriented organisations, these firms entered the OS field for gaining competitive advantages. They exploit collective developed software but do not take part actively in its production (*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= 0.006). Notwithstanding that most respondents (66.0%) declare to attach high strategic importance to Open Source, 57.1% offer indifferently open and proprietary solutions[1] (vs. 33.3% of the other firms, Chi Square Test, p value = 0.010). Few firms are in the second group, so the empirical evidence is poorly informative. Anyway it is worth noticing that 10 out 13 (76.9%) assign high score to EM2 proposition (*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.

The most intriguing groups are the third and the fourth. The former show strong community-oriented attitudes[2] and behave consistently with them. In general, these firms have adopted the new paradigm from the very start (early adopters: 88.9% vs. 59.3%, Chi Square Test, p value=0.004).

They all have joined at least one OS project and have social contacts with individual developers. The large majority has carried on coordination tasks and perform Open Source advertising and there is a corresponding an entry budget for this activity in almost half on the cases. 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.

Findings on *Opportunistic Firms* corroborate the hypothesis on the extrinsic nature of firms' community-based motivations. They 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 7).

No difference emerges as far as the exclusive use of the GPL is concerned (but only 3 the respondents in this group do not use this

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[1] Closed response question, options: exclusively OS solution; mainly OS solutions; indifferently Proprietary and OS solutions.

[2] No firm assigns low scores to IM1 and IM2 while than 20% assign low scores IM3. High scores: 96.3, 88.9% and 55.5%, respectively.

license) and in half of the cases proprietary and OS solutions are indifferently provided to the customers. The agreement with the OS values seems only nominal without being put into practise.

Table 7– Opportunistic firms behaviours, Chi Square Tests. Note. * p value < 0.1; **: p value < 0.5; ***: p value< 0.01.

Variable	Opportunistic Firms	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 advertising activities	72.7	73.9	0.889
% of firms in whose budget there is an entry devoted to OS advertising activities**	37.8	22.2	0.077

About the characteristics of the firms in the four groups, we discuss the following hypothesis. *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 process 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 *Community Oriented Firms*. Percentages are significantly lower in the other groups (38.5%, 38.0%, 55.6% respectively, Chi Square Test, p value=0.006)[3]. Findings on *Opportunistic Firms* are of interest, the fact that almost 60% 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 these companies to express community-oriented attitudes also without the corresponding behaviours. *Community Oriented* and *Opportunistic Firms* account for the 65.7% of the whole firms having D=1.

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[3] 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).

CONCLUSIONS

This paper adds to the literature by providing empirical evidence on 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, intrinsic, community-based motivations couple with extrinsic, profit-oriented incentives. 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 in [24] 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 so gaining competitive and cost advantages.

After grouping the respondents of the basis of the dimensions of this discrepancy, we suggest that the sub-group of firms that behave consistently with their attitudes are 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 it seems that its social connotation is going to survive via the passage of the hacker culture from individual developers to the Open Source firms.

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