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THE THREE DIMENSIONS OF A COMUNITARIAN INSTITUTION:

The Open Source Software Community Case

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The three dimensions of a communitarian institution.

The “reflexive identity” concept and the FLOSS community case

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Abstract

The analysis of the empirical studies relative to the Free/Libre/Open Source Software (FLOSS) case highlights the necessity to enlarge the set of categories used to describe developers’ incentives. In particular, the evidences stress the important role played by another category of incentives, broadly and roughly defined as “psychological and social motivations”. However, the theories elaborated to cope with this dimension, such as “gift economy”, “epistemic community” or “community of practice”, are not combined into a unique structured framework. Each one of them, in fact, is focused on particular features of the FLOSS model, so that the FLOSS community itself is often described as a “hybrid institution”, obtained combining different perspectives. However, it is possible construct a mechanism –here called “reflexive identity”- able to bridge the analyzed theories and to explain the empirical evidences left aside by self-supply, reputation and signaling. The reflexive identity mechanism develops through the nexus of ties connecting the community members. In order to cooperate, members have to “negotiate” the system of meanings they use to interface with the world and with the communitarian environment. But this means reshaping also their own vision of the world, redefining their values and thus their identity. The space opened by the negotiation, then, is the space where community aims, principles and *ethos* act directly on members’ identity, making them internalize the communitarian structure of rules. The reflexive identity principle, then, merges the psychological and social dimension of the FLOSS phenomenon with the structure of rules adopted by the FLOSS community, and thus it constitutes together with self-supply, signaling, reputation and peer regard the basis upon which the FLOSS community is built.

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1. Introduction

1.1. Why Free/Libre/Open Source Software?

One of the main challenges the development of the information society imposes to the economic theory is the assessment of the changes in its institutional system. Moving from the production of physical goods to the production of information and knowledge, in fact, implies a reshaping of the structures upon which society has been constructed. The birth and persistence of an open model of knowledge production –where agents develop and distribute knowledge without external founding or rents assured by the IPR regime- represents one of the most important novelties introduced by this process of change (David and Foray, 2003). In particular, the Free/Libre/Open Source Software (FLOSS) phenomenon seems to be one of the most interesting cases through which this open model can be approached and studied¹.

How can such an analysis of the FLOSS case be approached? One possibility is to “unpack” the structure of the FLOSS organization and to derive directly from it the organizational determinants of the model (Giuri *et al.*, 2004; Garzarelli, Galoppini, 2003; Garzarelli, 2003; Narduzzo, Rossi, 2004). A second approach is a historical one, where the FLOSS mode of production is compared to other example of collective inventions (Allen, 1983) in order to make its peculiarities emerge (Osterloh, Rota 2004; Nuvolari, 2003). In the present paper, however, I will following a third path, tracked by Dasgupta and David (1987, 1994) in their assessment of the institutional structure of the IPR regime and of the academic research. In this case, the analysis of the FLOSS case have to be based on the description of the *incentives* induced by the rules, the roles, the social structure that the FLOSS community embodies. In what follows, then, the focus will be on the incentives scheme the FLOSS community institutional structure provides its members with.

1.2. The FLOSS and the motivations underpinning it

The literature relative to the FLOSS developers’ incentives has initially focused on two main mechanisms: a) self-supply b) signaling and reputation². The idea is that FLOSS developers

¹ FLOSS is produced by developers collectively, each one of them contributing to a public good (the final software) without any direct economic gain (such as money or exclusive control of the product). In order to have an idea of the main characteristics of the FLOSS phenomenon consider Giuri *et al.* (2002), Himanen *et al.* (2001), Raymond (1998a, 1998c), Williams (2002), Torvalds and Diamond (2001), the web site of the *Open Source Initiative* (www.opensource.org/) and of the *Free Software Foundation* (<http://www.fsf.org>). To enter the economic debate developed around FLOSS two of the best sources are <http://www.infonomics.nl/FLOSS/index.htm> and <http://www.stanford.edu/group/floss-us/>.

² Peer-regard (Dalle and David, 2003; Dalle *et al.*, 2004) is complex phenomenon, involving also psychological and social aspects. In order to avoid the overlapping of the different incentives realms, I will consider mainly reputation and signaling. *Mutatis mutandis*, similar reasoning can be done for peer-regard, even if in this case the intersection with psychological and social mechanism has to be recognized and “discounted”.

produce software because they cannot easily find in the market what they need (Bessen, 2001) and/or because they want to signal to the community as a whole or to the job market their capabilities (Lerner and Tirole, 2002). However, as showed by Osterloh and Rota (2004) and Rullani (*mimeo*), these two incentives alone are not enough to justify the incredible growth of the FLOSS community. The empirical analysis seems confirm this point of view showing that self-supply and especially signaling and reputation are not ranked among the most important developers' motivations. On the contrary, incentives related to the social and psychological dimension of knowledge sharing seem to play a fundamental role. For a more realistic description of phenomenon then we need to explain and “unwrap” this last finding.

In recent years many economists studying the FLOSS community moved their analysis also outside the economic field. Talking about communities this movement appeared a necessity. The communitarian institution, in fact, can be placed on the boundaries between economics and all the other social sciences. Understanding the community structure -and especially its incentive scheme- means then taking into account also some of the insights produced by theories developed inside other fields. To approach this third dimension some authors applied theories coming from anthropology (e.g. gift economy), sociology (e.g. community of practice) and psychology (e.g. the studies relative to intrinsic motivation) to the FLOSS case. The insight they provided is impressive, but these theories are not yet structured around a common principle, able to bridge them. The result is that the FLOSS community is most of the time seen as a hybrid obtained interlacing different theories. More research to grasp the inner principle characterizing the social side of the FLOSS community –its *social engine*- is then needed.

This paper moves along this path. In the first section self-supply, signaling and reputation incentives are assessed from a theoretical and an empirical point of view. In the second section some of the empirical evidences relative to the psychological and social dimension of the community are presented and some of the theories relative to this aspect of the incentive scheme are described. In the third section the findings of the previous analysis are elaborated in order to search for the “common principle” –if any- we are looking for. The result is that we are in fact able to define such a principle, that we called “**reflexive identity**”.

The reflexive identity mechanism acts through the nexus of social ties which constitutes the infrastructure of the community. In order to cooperate and interact members have to negotiate a "system of meanings" upon which a reciprocal understanding can be based (Habermas, 1968, 1981; Wenger, 1998; and Lave and Wenger, 1990). However this process does not let the individual's identity unvaried. “To negotiate a system of meanings”, in fact, means comparing one's own point of view with the other members' points of view in order to merge the different visions of the world

into a meaningful system. In other words, cooperation necessarily implies a modification of each interlocutor's system of values, principles, aims, and thus of her own identity. With the modification of the individual identity comes the reshaping of the individual payoff function, which now has to move around different aims, is differently sensitive to different incentives and leads the members of the community towards the internalization of the communitarian rules.

2. The basic incentives

2.1. Signaling, reputation and self-supply

The first kinds of incentives highlighted in the literature relative to FLOSS were signaling, reputation (Lerner and Tirole, 2002). Producing code and openly distributing it developers can signal their ability, gaining reputation and future work opportunities. Linus Torvalds, the "father" of Linux, states: "There's a lot of tangible *indirect* value for doing Linux. I may not get paid directly from the Linux project itself, but my current work position is obviously in large part due to Linux" (Ghosh, 1998b). Similarly, Ghosh (1998a) notices that the diffusion of the internet made the "cyberspace" a place where ideas (and software) can be exchanged to increase their producer's reputation so that "reputation [can be considered] a currency, i.e. a proxy, which greases the wheels of the economy", Ghosh (1998a). Dalle and David (2003) and Dalle et al. (2004) consider peer-regard -here considered similar to reputation³- as the main force driving the developers' choice of which specific project to join⁴. The same factor is underlined by Raymond (1998b), who considers acquiring status and recognition as the key incentives pushing developers to openly distribute their code.

The definition of the second kind of incentives is rooted in von Hippel's insight (1988) on the role of users as source of innovation. The main idea is that if users are expert enough to improve directly the product they consume, they are also provided with a series of incentives to innovate. As von Hippel (2001) argues, information about users' needs is "sticky", and manufacturers cannot cheaply acquire it (von Hippel, 1994). Furthermore, manufacturers need to reduce their production costs creating an as much as possible standardized product. Thus, expert users are expected to innovate in order to fill the gap between their needs and the software. Moreover, in the case of software the intrinsic complexity of the product decreases the probability that other expert users need a bundle of features similar to the bundle one particular expert user needs. Waiting in order to see if others

³ See footnote 2.

⁴ The authors describe the space of motivations as composed by *overall motivations*, determining the choice of joining or not the community, and *motivations-at-the-margin*, leading the developers' choice of the particular project they will join. The drivers of each one of the two dimensions can be different. The hypothesis of the authors is that in the case of *motivations-at-the-margin*, the individuals' preferences are defined by the 'Economy of Regard'.

develop the software one needs -which is the rational strategy in the case of public goods- is then less appealing, because the user is likely to wait for a long time (Bessen, 2001). The expert user is then pushed to innovate. But why should a user freely reveal her innovations? First of all, in the FLOSS environment revealing has a very low cost, because software can be shared immediately, at no cost and with a virtually infinite number of other developers through the internet. This multiplicative effect has been described by Ghosh (1998a) as the "cooking pot" mechanism. Second, in the software realm –as in the codified knowledge one- there is no rivalry in consumption (Shy, 2000). The cost of revealing is then decreased by the fact that disclosing the innovation does not restrict innovator's access to its consumption. Thus, given such a low cost of revealing, even a very low gain –as reputation, learning or job opportunities- can be enough to trigger the disclosure (von Hippel and von Krogh, 2003).

Remaining in the realm of self-supply, there is a third important force pushing towards disclosure: the expectation of others' reciprocal behavior⁵. The power of the "cooking pot", in fact, is such that developers can decide to make available their code simply because they understand that -if others do the same-, it is possible to realize an enormous division of labor. Developers with similar needs can cooperate and obtain complex results with disproportionate savings in effort and time⁶. However, this reasoning is based on expectations. If we suppose that at the beginning each developer faces a Prisoners' Dilemma in which "strategic waiting" is the dominant strategy, we need to introduce an institutional mechanism to move the game towards a cooperation game where the expectations about others' behaviors converge towards cooperation. We will see that the "reflexive-identity" process can be considered that mechanism⁷.

Following this line of research, the synergy between self-supply and signaling incentives could be considered as the engine of the FLOSS community. The model by van Wegberg and Berends (2000) gives theoretical ground to this situation, and highlights the forces acting in such a community. However, is this situation realistic?

⁵Always on the self-supply side there are other reasons for disclosure, as the willingness to influence the trajectory of particular software, or to impose the innovation as a standard (Harhoff *et al.*, 2000).

⁶For example, in the Lakhani and von Hippel's (2002) study of the Apache Usenet help system the authors found that despite an information provider spent only 2% of her time on the site in answering questions and 98% in gathering information for her own needs, the help system was efficient precisely because of the multiplicative effect of the "cooking pot" mechanism.

⁷As Gambardella and Hall (2004) notice, another institutional mechanism having similar features is the General Public License (GPL). On the one hand the GPL provides the licensee with the possibility to enter the code of the program, to modify it and to redistribute it. On the other hand it forces the licensee to apply the same license scheme to the derived products. The GPL, then, coordinates developers' expectations a) erasing some free riding strategies (i.e. taking free software and producing a proprietary modification) from the set of all the possible strategies and b) forcing developers to face the trade off of being inside (and following the rules) or outside the FLOSS community.

2.2. The empirical evidence about self-supply

The aim of this section is approaching the empirical analysis carried out in the FLOSS field to understand the power of the reputation/self-supply models in explaining the FLOSS reality.

Let us start with the self-supply side of the model. In the Boston Consulting Group survey (Lakhani *et al.*, 2002). just 22.3% of the answers to the question "How likely would you be to contribute to a Free/Open Source software project that delivers more direct value primarily to average users than to you or your peer group?" were "unlikely" and "very unlikely". In the same survey, in the rank of reasons for contributing to software development⁸ self-supply ranks 4th, behind intellectual stimulation in writing code, learning, and the belief that code should be free. These results seem to limit the explanatory power of self-supply. Consider also another study. Bonaccorsi and Rossi (2003b) use a meta-analysis approach to compare motivations of firms working in the OSS scene (usually supplying services) and developers' motivations gathered from different surveys. Firms and developers have very different roles (service supply vs. software development), and for our purposes cannot be easily compared. Nevertheless the analysis is very interesting because firms' motivations can be used as a kind of benchmark. Firms are profit-seeking actors, and the comparison between them and developers can be useful to understand how and when the latter deviate from a profit-seeking behavior. The results seem to confirm the limits relative to self-supply. In taking their decision about FLOSS, developers care much less than firms about reliability and quality of the software (it is an important incentive for 11% of developers against 38% of firms), and only 27% -against 41% the of firms- underlines the importance of feedbacks from the community. Firms seemed more motivated by the possibility to improve their products/services thought the community effort, i.e. they seem to be more self-supply-oriented than developers.

These limits can be anecdotically described referring to some examples. When Linus Torvalds decided to develop a function he called *page-to-disk*, he did it only because a German developer - and not Linus himself- needed that software⁹. Self-supply, then, was not the explanation. For similar reasons it is difficult to use this argument to explain the creation and the success of GUI¹⁰ projects, as Gnome and KDE, instruments mainly needed by non-expert users. Moreover, the birth of the Gnome project can be seen as a *duplication* of the KDE one, and thus again outside the self-supply explanation. Explanation that instead was "ideological". The idea was that the KDE project was following a wrong direction in terms of use of proprietary software, and that another *totally free* project was needed. As Stallman states it: "[Gnome] has technical advantages [...]. But its main

⁸The data refer just to volunteer contribution to isolate the incentives which are not related to direct earning as wages. In the survey both aggregate and disaggregate data are available. See Lakhani *et al.* (2002).

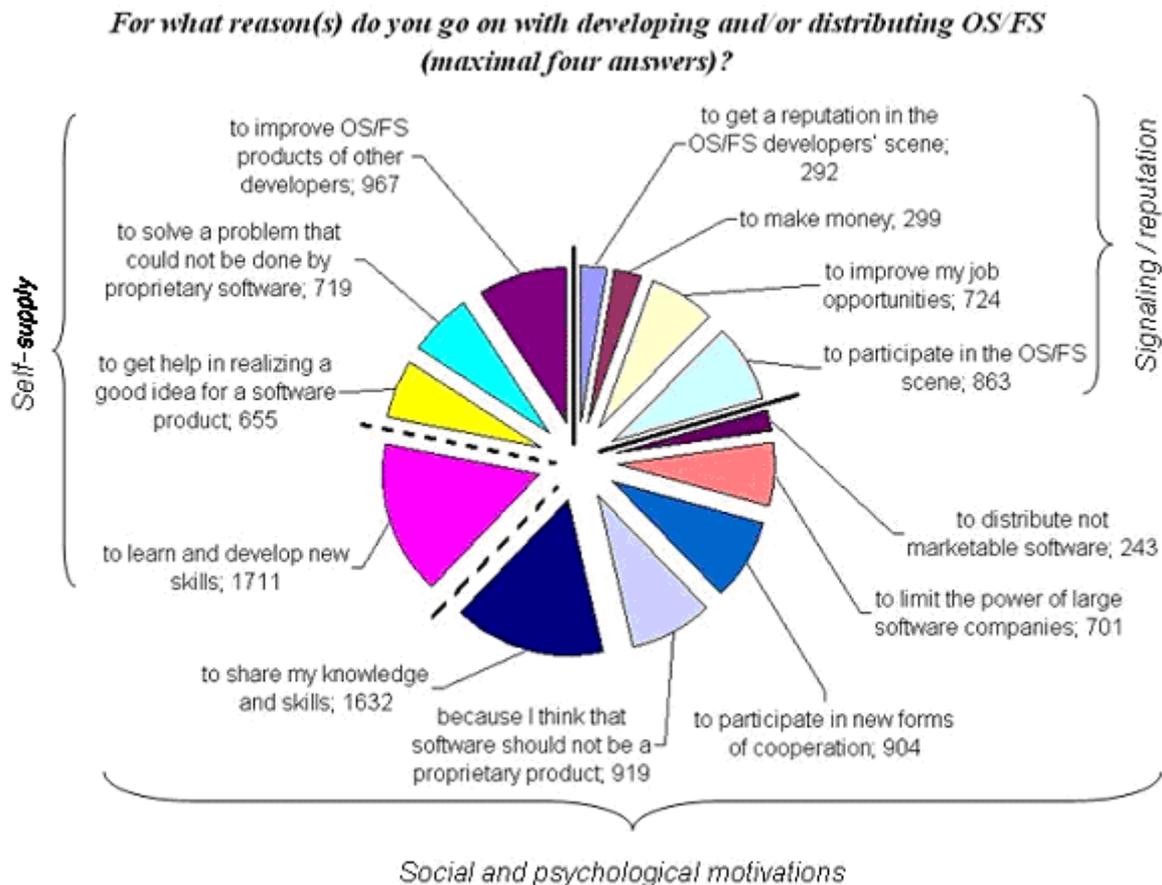
⁹The episode is described in Torvalds and Diamond (2001).

¹⁰The acronym for Graphical Users Interfaces.

purpose was freedom: not to require the use of any non-free software", Stallman (1998b)¹¹.

However, the importance of self-supply should not be underestimated. Consider the figure 1 obtained from FLOSS-EU survey data¹² describing developers' motivations. It is easy to see that self-supply is generally important¹³.

Figure 1. Developers' motivations (frequencies of the answers).



Source: FLOSS-EU survey. The classification of the motivations is ours.

Also the FLOSS-US¹⁴ survey confirms that self-supply, even if important, is just one of the leading

¹¹See <http://www.gnome.org> and <http://www.kde.org> for further information.

¹²See Ghosh *et al.* (2002). See also the questionnaire at <http://www.infonomics.nl/FLOSS/floss1/stats.html> and the FLOSS-EU web site at: <http://www.infonomics.nl/FLOSS/>.

¹³In figure 1 the motivation "to learn and develop new skills" -which is the most relevant with 1711 preferences- has been classified in between self-supply and social and psychological motivations (the dashed line expresses this duality). This has been done because learning is complex process which involves an individual and a social dimension (Wenger, 1998). The role of the polyhedric structure of learning will be assessed in the next sections. In general, however, surveys are not so easy to interpret. For example the authors of the FLOSS-EU survey consider motivations such as "improve OS/FS products of other developers" and "distribute not marketable software products" as signaling or reputation-related motivations. Similarly, in some other section of the survey, they consider signaling-related answers statements like "FLOSS community is a forum: to exchange knowledge" "for people who look for a project partner" and "for innovations breakthroughs". However, most of these variables can be "spurious", being affected by different kinds of motivations. For example, looking for a project partner seems much more related with self-supply dynamics than with signaling and reputation. Given this, we tried to apply a classification which in our opinion reduces the overlapping of different motivations groups and helps in isolating the effect of each incentive.

¹⁴ See the FLOSS-US survey at <http://www.stanford.edu/group/floss-us/> and the specific context of this question at

motivations among others.

Table 1. Developers' motivations (percentage of the answers).

"For what reason(s) do you go on with developing and/or distributing OS/FS (maximal four answers)?"	Type	%
<i>I thought we should all be free to modify the software we use</i>	SP	78.59
<i>As a user of free software, I wanted to give something back to the community</i>	SP	77.79
<i>I saw it as a way to become a better programmer</i>	SS/SP	68.68
<i>I thought it was the best way for software to be developed</i>	SP	68.62
<i>I wanted to help provide alternatives to proprietary software</i>	SP	61.88
<i>I wanted to interact with like-minded programmers</i>	SP	57.19
<i>I needed to perform tasks that could only be done with modified versions of existing software</i>	SS	56.32
<i>I wanted to find out more about how a particular program worked</i>	SS	54.68
<i>I needed to fix bugs in existing software</i>	SS	53.14
<i>I liked the challenge of fixing bugs and problems in existing software</i>	SP	40.49
<i>My employer wanted me to collaborate in open source development</i>	None	7.16
<i>Another reason</i>	-	68.48

Source: FLOSS-US survey. Notation: SS=Self-supply; SP=Social and Psychological motivations; None=none of the previous. Signaling motivations have been listed among "Other motivations". The classification is ours.

Summarizing: it is difficult to think that self-supply is the main incentive moving FLOSS developers, even if it remains among the most important factors.

2.3. The empirical evidence about signaling

Similar arguments can be stated for signaling. First of all, reputation gains cannot be assumed to be the incentive of the "obscured developers" described by Dalle and Jullien (2000). These developers, in fact, contribute just with few lines of code, with patches and bugs reports. These activities are too "peripheral" to be connected with reputation gains. So the signaling incentive does not hold in many cases. But even for what concerns the "stars" of the FLOSS consider what Linus Torvalds states in the already quoted interview: "The 'fame and reputation' part came later, and never was much of a motivator, although it did of course to some degree enable me to work on it without feeling guilty about neglecting my studies", Ghosh (1998b). And in fact, as Weber (2000) emphasizes very well:

"If reputation were the primary motivation, [...] programmers should compete to become project leaders, [...] We would expect to see a significant number of direct challenges to Torvald's leadership, but in fact there have been few such challenges, none serious. Alternatively, we could see 'strategic forking'. A strategic forker would fork a project not for technical reasons per se, but rather simply to create a new project that he or she could lead. The problem with this kind of story is that it simply hasn't happened. There are no significant examples of this kind of behavior in the Linux history. [...] Nor does it seem that the 'system' or perhaps Torvalds has anticipated this kind of pressure and pre-empted it by his own strategic behavior, [...] The bottom line is that there simply is not as much strategic behavior in reputation as we would expect, if the Lerner/Tirole emphasis were correct. Part of the counterpoint to a competition in reputation comes from strong elements of shared identity within the community of developers".

To strengthen again this point consider that, as Lancashire (2001) notices, the Apache and Perl cases, upon which Lerner and Tirole's (2002) theory is built together with the Sendmail case, represent peculiar cases where commercial interest and communitarian incentives are mixed. From the analysis of these cases it is then not so easy to conclude that reputation or signaling are strong enough incentives.

Moreover, in the already described Boston Consulting Group survey (Lakhani *et al.*, 2002) signaling ranks 8th, while reputation is 9th among the reasons for contributing to develop software¹⁵. Also in FLOSS-EU survey (Ghosh *et al.*, 2002) signaling and reputation appear to be a second order problem: to the question "Do you mark the code you provide OS/FS as yours [...]" 35% answers "Yes, but it is not important to me", while 6% answers "No". In the same survey, emerges that only 4% of the sample considers the OS/FS scene as a forum for career improvements, and that -as tell us figure 1- reputation incentives are considered by developers not very important. Also from the already quoted work by Bonaccorsi and Rossi (2003b) emerges that "developers surveys show that gaining reputation among peers does not rank among the main incentives of the Free Software programmers [...and] firms are not unlike the individual programmers" (p. 25)¹⁶.

¹⁵As before, here we consider data relative just to volunteer contributors. See Lakhani *et al.* (2002) for aggregate data.

¹⁶However, in the same paper, the direct comparison between two consistent databases shows that "developers assign high scores to items dealing with reputation gain, code reciprocation within the Free Software community, software freedom and learning", p. 28.

The conclusion is that what has been said for self-supply is *a fortiori* true in the case of signaling and reputation.

3. The challenging incentive: the social dimension

In a nutshell, the empirical analysis tells us that the importance of self-supply and signaling/reputation related incentives is not enough to explain the growth of the FLOSS community. So we have to search for other categories of motivations.

3.1. The empirical evidence relative to the social dimension

To do that, let's focus on the empirical evidences relative to what has been left aside above.

In Lakhani *et al.* (2002)¹⁷, among all the reasons for contributing to software development, learning and the belief that code should be free rank second and third, behind intellectual stimulation in writing code (1st). Personal obligation to reciprocate and "I like working with the development team on this project" rank 5th and 7th, respectively. Consider that the creation of needed functionality, which is related to self-supply, is 4rd (6th if the functionality is job-related), and that signaling and reputation rank 8th and 10th, respectively. Eventually, consider that 83% of the sample believes that "hackers are a primary community with which I identify"¹⁸.

From the FLOSS-EU survey we derive most developers consider the FLOSS scene as a forum: that enables more freedom in software (64%, 1st), to exchange knowledge (57%, 2nd), for people with the same interest (16%, 6th) and for a general discussion about software (16%, 7th). Take now into account figure 1 constructed on the data from the same survey. Consistently with the results seen before, factors connected to the learning, identity and social dimension are usually considered important. Moreover, the psychological perception of the developing activity appears to be important. Working in the FLOSS is considered much more *joyful* than working on proprietary software by 78% of the sample, while only 0.35% states the opposite and 18% consider joyful both activities. The FLOSS-US survey (at <http://www.stanford.edu/group/floss-us/>) confirms this result. Consider table 1: motivations clearly related to the social and psychological dimension of the community as "I thought we should all be free to modify the software we use" or "As a user of free software, I wanted to give something back to the community" rank first and second, respectively.

As said, the meta-analysis by Bonaccorsi and Rossi (2003b) let us compare developers' motivations and the incentives of profit-seeking actors as firms. Developers show much more interest than firms with respect to social motivations, defined around freedom of the code, values of the community

¹⁷Again, here data are relative just to volunteer contributors. See the survey for data regarding paid contributors.

¹⁸42% strongly agrees with the statement, 41% somewhat agrees, 9% is not sure, 5% somewhat disagrees and 3% strongly disagrees.

and willingness to make skills and code disposable for the community. Even if this result sounds obvious, it states that actors which are in the FLOSS scene just for profit do not care -neither in instrumental terms- on social motivation as developers do. This highlights the importance of social motivation *as such*, independently from their instrumental use.

Eventually, consider that the role of the social dimension is central also ethnography studies, as in the case the "GNUenterprise.org" studied by Elliott and Scacchi (2003).

Given this, the main groups of incentives that should be taken into account in our analysis seem to be *creativity, sense of identity, learning and social incentives*.

3.2. *The literature about the social dimension of the community*

How the economic literature can explain these results? In general, economists tend to separate the realm of economics from the realm of other social disciplines leaving aside mechanism not directly connected to economic categories. However, the dimension of *homo economicus* has been recognized to be too narrow to make it directly applicable to a broad range of social phenomena where economic mechanisms –or at least consequences- are actually at work. Adam Smith's concept of sympathy and the apparent inconsistency between his *Theory of Moral Sentiments* (1759) and *The Wealth of Nations* (1776) are still the topics of a heated debate, showing that the idea of *homo economicus* is not well defined yet¹⁹.

In the specific field of institutions, moreover, the social dimension acquires a particular role, being the organization's culture one of the fundamental bases upon which institutions are built. Thus, studying an institution as a community we should take into account the psychological and social dimension. On the FLOSS side, in fact, a great part of the literature²⁰ agrees on the central role of the social context and of the actors' psychology in explaining the FLOSS community growth. But in the empirical analysis as well as in the theory the social dimension is sometimes taken as exogenous and just sketched. Some other times ideologies, rules, attitudes of the FLOSS community members are approached, but in a schematic and "atomistic" way, isolating single mechanisms and focusing just on them. Or the focus is specifically on the social dimension and the foundation of an endogenous social mechanism is explicitly considered, but even in this cases, the "fuzziness" of this dimension and the consequent wide range of possible mechanisms at work

¹⁹Asked to forecast the future development of the economic science, one of the answers Richard Tahler (2000) gives: "[I]t seems right to offer the slightly more courageous prediction that Homo Economicus will become more emotional, by which I mean that economists will devote more attention to the study of emotions".

²⁰See, among others, Weber (2000), van Wegberg and Berends (2000) and Lakhani and Wolf (2003), Bitzer, Schrettl, Schröder (2004).

makes difficult to merge these studies into a wider and more general framework²¹.

The aim of this section is trying to identify a bridge connecting some of these theories together and with the empirical evidences, to define in a more structured way the psychological and social horizon of a community.

3.3. *Extrinsic/Intrinsic motivations*

Self-supply and reputation and signaling gains have an "extrinsic" nature. The developing activity is simply a means to reach a different goal: the consumption of the produced software, recognition by peers or a better position in the market for developers. The connection between the activity (developing software) and the produced value is only instrumental. Following Deci (1975), these extrinsic motivations are opposite to what he calls "intrinsic" motivations, defined as incentives based on the agents' satisfaction in undertaking a particular activity. With respect to the FLOSS case, Lakhani and Wolf (2003) exemplify this kind of incentives as feelings like "fun", "challenge", "sense of creativity". But this category is much broader than that -as the two authors states- and also community based incentives should be included in the intrinsic-incentives horizon (Lindenberg, 2001). Moving to a broader view of the community means moving from an "extrinsic" payoff function to a broader one, filled with the "intrinsic" side of the communitarian relationship. In terms of game theory, this means moving from the Prisoners' Dilemma towards a Coordination Game in which players share a social structure able to coordinate their expectations around reciprocity, and thus around coordination. As von Hippel and von Krogh (2003) states it: "Recent developments in economic theory [...] have shown that a game, which in material payoffs constitutes a Prisoner's Dilemma, can be transformed into a coordination game in which cooperation is also an equilibrium outcome if pecuniary motivations *and* social motivations are taken into account", p. 9.

3.4. *Theories of interaction applied to the FLOSS community*

Moving then to the social dimension, several points of view have been adopted to describe the social mechanism underpinning this movement towards cooperation. During recent years, a lot of different models from sociology and social psychology have been adapted to FLOSS (see, among others, Hertel, Niedner, Herrmann, 2003; O'Mahony, 2002). However, four theories have attracted the majority of the authors' attention: gift economy, community of practice, epistemic community and reciprocity rules.

Raymond (1998b)²² defines FLOSS as a "gift economy". In such an economy individuals donate

²¹ Consider how Healy and Schussman (2003) describe the activity of the community: "[The OSS development] is a hybrid: part social movement, with idealistic principles and goals; part formal organization, with an intensive schedule and innovative products; part volunteer network, with time and energy to donate", p. 2.

²²See also Tapscott *et al.* (2000).

their resources -in our case, spend their effort developing software and distributing it- to improve their *status*. The mechanism of the gift, anthropologically grounded in the work by Mauss (1923), has been placed at the foundation of social entities as communities because it carries the incentive to reciprocate and to establish social ties among a group of individuals. The same mechanism, then, can be seen as the basis of the FLOSS community (Berra and Meo, 2001).

Other theories, partly taken from sociology, tend to focus on the relationship among members. The "epistemic community" (Haas, 1992) and "community of practice" (Lave and Wenger, 1990; Brown and Duguid, 1991) concepts belong to this horizon of research. In both the theories the central mechanism by which the community reproduces itself and at the same time creates knowledge is the *learning* process. Learning can be thought as the replication, systematization and augmentation of the knowledge base of the community which is realized *through the interaction of its members*. In particular, the learning activity is a "negotiation" of ideas (Wenger, 1998) carried out by members that *acts back on the members*, defining the rules, the codes, the roles, the points of view on the communitarian problems that they decide to adopt. The involvement in the social learning of the community is the main mechanism by which a community -epistemic or based on practices- can sustain its own activity. In the literature (Cohendet *et al.*, 2001; Edwards, 2001; Tzouris, 2002), FLOSS community has been usually recognized as an "hybrid" community, where some of the epistemic elements merge with the practice horizon²³.

Another part of the literature concerning the social dimension of communities focuses mainly on rules²⁴. Experimental results have shown that Granovetter's "embeddedness" (1985) is a fundamental concept. Subjects involved in a nexus of social ties transpose some of the social rules into the economic environment, deviating from the "classic" homo economicus' behavior²⁵. However, the extent at which some of the rules, as altruism (Andreoni, 1990) or fairness (Rabin, 1993), can be considered the "pivot" of the FLOSS community is "short", because of the particular communication involved in this community (Computer Mediated Communication) and the openness of the community which "relaxes" the social ties. But other rules, and especially *reciprocity*²⁶, can be considered fundamental for the OSS community. In particular, the concept of

²³ See Mateos Garcia and Steinmueller (2003) for an interesting evaluation of this concept.

²⁴ Mateos Garcia and Steinmueller (2003) developed a deep analysis of the institutions construction in The FLOSS community. As the community grows bigger, there is the necessity to structure the social interaction building institutions able to reduce the complexity and at the same time to enhance participation and trust. The institution they identify is *distributed authority*, which takes also the form of a "bundle" of rules accepted by the community members. At the stage of the analysis, however, we focus on more general rules of behavior, connected to the choice of participating in a public good production as the FLOSS one.

²⁵ See Spagnolo (1999) for a formalization of the principle

²⁶ See Keser and van Winden (1996), Gächter and Falk (2001), Bowles and Gintis (1998), Fehr and Falk (2002) and Dufwenberg and Kirchsteiger (2000)

"general reciprocity"²⁷ offers an interesting perspective on the problem. The reciprocity observable in the FLOSS is different from what is usually meant with reciprocity. It is *diachronic* (giving and receiving are separated by an unknown period of time) and *asymmetric* (giving to member A of a community does not necessarily imply receiving from A, but even from other members). The term "general" or "generalized reciprocity" captures these characteristics, which seem to correspond roughly to the creation of a reciprocal relationship between each member and a social subject represented by the whole community. Notice that this concept is different from "generic altruism", i.e. it does not develop as a unidirectional movement of the subject towards everybody else. As Sacco and Zamagni (2001) argue, in fact, "reciprocity should be distinguished from pure altruism or philanthropy, which expresses themselves in isolated, one-directional transfer. [...] Reciprocity takes up the intermediate position between market exchange and pure altruism". With respect to the FLOSS, an argument relative to the general reciprocity perspective and its role in the community is put forward by Luo (2002).

After this very short review, a question is however left: Is it possible to find a common principle, an "engine" working behind all these social mechanisms and able to bridge them with the empirical evidence?

4. The "reflexive identity" concept

4.1. The background

To answer the question we can take into account the work of two economists who tried to broaden the "horizon" of the homo economicus. Sen (1985) states that "the pursuit of private goals may well be compromised by the consideration of the goals of others in the group with whom the person has a *sense of identity*. [...] The sense of identity can operate through making members of a community accept certain rules of conduct as part of obligatory behavior" (p. 348-349, *emphasis added*). Hirschman (1984), moreover, writes "Noninstrumental action"²⁸ in general makes one feel more human. Such action can then be considered, in economic terms, as *an investment in individual and group identity*" (p. 151, *emphasis in the text*). In both the quotations, "identity", meaning the "feeling of [...] belongingness and personhood" (Hirschman, 1984, p. 372), is crucial. A similar point of view is expressed by Akerlof And Kranton (2003) "[...] a source of motivation is missing from current economic models of organizations. [We] characterize this missing source as *identity*. By identity we mean a person's self image — as an individual and as part of a group. The

²⁷See Foray (2003) for a discussion about FLOSS in the framework of David and Foray (2003).

²⁸"[N]oninstrumental activities [...] are undertaken 'for their own sake' and [...] 'carry their own reward' ", p 369. As it

rituals [...] and other organizational features can change the way people see themselves; they become part of the organization and internalize its rules. In [...] organizations, such identification - or lack of it - plays a critical role in determination of work effort, incentive schemes, and organizational design”, p. 1.

The concept of “identity”, then, seems to be one of the most important dimensions through which economics should expand homo economicus’ concept. In particular, as we will see in a while, these authors’ description of the properties of identity can be organized and generalized into the concept of “reflexive identity”, and thus transformed into the bridge-concept connecting the theories described before. Incorporating the idea of reflexive identity into the study of FLOSS community, we are able to explain the empirical evidences analyzed before, so that it seems to grasp what has been left aside by signaling, reputation and self-supply. To see how this reasoning evolves, consider what follows.

4.2. The reflexive identity mechanism

As Wenger (1998) underlines, the nexus of ties that constitutes a community is a twofold space: on the one hand the common space is used to produce the artifacts of the community, on the other hand in the same space -and together with the first activities- individuals construct their “representation of the world”. With this last term we mean the semantics, the system of “meanings”, through which reality is organized and filtered to be intelligible. The way we see -and most important understand- the world is in fact immersed in a collective negotiation of meanings (Wenger, 1998), in which each member of a community relates to the others in order to define and evaluate (i.e. give a meaning to) a certain system of facts (Habermas, 1968, 1981). Reality can then be seen as a social construction²⁹ (Elliott, Scacchi, 2003; Micelli, 1999, 2000).

Again Wenger (1998) notices that this inter-subjective process in shaping the vision of the world of each individual acts back on each community member, re-defining her values, principles, aims, meanings. In other words: re-defining her identity³⁰. Golden-Biddle and Rao (1997) describe this mechanism in the field of nonprofit organizations: “Organizational identity –the shared beliefs of members about the central, enduring and distinctive characteristics of the organization- constitutes part of the shared meanings held by members. In a social construction perspective, identity becomes an important collectively-held frame invoked to make sense of their world [...]. Identity influences

is easy to see, the definition overlaps with the concept of intrinsic motivated activities.

²⁹To understand better this concept one could refer to the description Popper (1934) make of the reality studied by the scientific community. The system of meanings defining the space in which science researches is undertaken (its “ontology”) is in fact a social construction produced by the dialog among scientists.

³⁰See also Bressler and Grantham (2000) and Micelli (1999) and (2000). To see how this process could work in practice and in particular in a virtual environment see Rheingold (1993) and Preece (2000). A more sociologic point of view on virtuality and identity can be found in Levy (1984), Ferri (1999) and Carbone and Ferri (1999).

not only how members define themselves, but also their interpretation of issues and roles, responses to problems, and feelings about outcomes”, p. 594. At the end, then, the individual necessity to organize the reality into a structure of meanings triggers a process of interaction through which individual identities are shaped (Westenholz, 2003). It is through this negotiation that the principles and the rules of the community are internalized by its members. For example, "cooperation reflects a transformation of individual psychology so as to include the feeling of solidarity, altruism, fairness, and the like. Collective action ceases to become a prisoner's dilemma because members cease to regard participation as costly: it becomes a benefit in itself, over and above the public good it is intended to produce"³¹.

The relationship between the community and the individual is now set to a different cost/benefit structure, because the individual's payoff function has changed to take into account the new scale of values and principles originated by the interaction. Free riding, then, is not only a condemned and punishable behavior: it becomes a secondary option, simply neglected by the members³². It is impressive understanding how in a huge and to a certain extent impersonal community as the FLOSS one the free-riding phenomenon is considered irrelevant. In relating with other developers, very few members consider this option as a strategy, and similarly they do not expect the others to free-ride. One part of the explanation can be obtained referring to the system of the formal rules, as GPL, that sustains the community (Gambardella, Hall, 2004). But "around" the GPL and outside it (e.g. BSD) many free-riding behaviors -as the strategic waiting- are possible. Nevertheless, as O'Mahony (2003) demonstrates, we do not observe these behaviors, nor a rigid monitoring structure able to prevent them. So why are developers insensitive to this risk? Some evidences put under a different light the role of free-riding: "Open Source communities permit some members to take much more than they give, provided they do not violate minimal membership rules. [...] The literature on CPR, public good provisioning and free riding has probably over estimated the potential destructive role of small number of non contributors, assuming that their behavior should inevitably self-propagate. This is not necessary true", Bonaccorsi and Rossi (2003a)³³. Following

³¹ Elster's words as reported by von Krogh *et al.* (2003), p. 9.

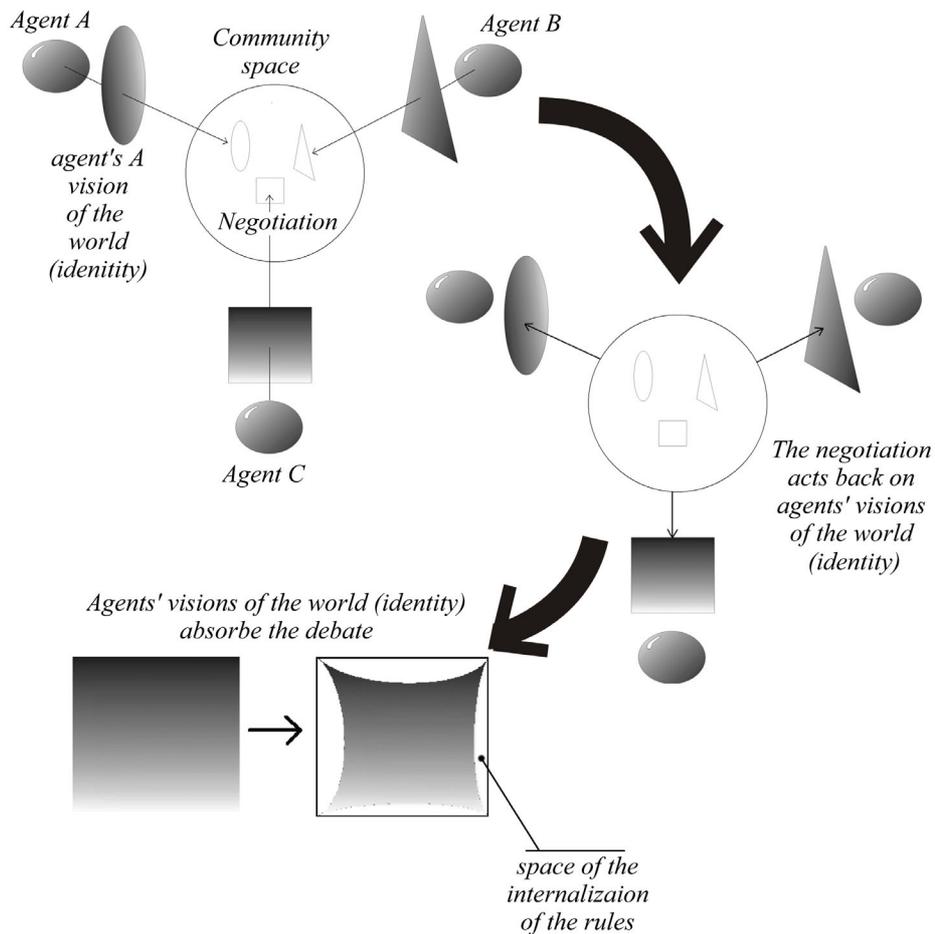
³² Notice that these considerations are mainly built a) on the results of the empirical studies described above and b) on conversations with some of the members of the Free Software Users Group (FSUG) Pluto-Padova, the first and biggest group in Italy (<http://www.dei.unipd.it/info/linux/home.it.html>), and the Venice Linux Users Group (<http://www.velug.it/>). The interviews took place at the end of 2001 and beginning of 2002, both face to face and through the FSUG mailing list at: <http://www.lists.pluto.linux.it/mailman/listinfo/pluto-pd>.

³³ For an account of the free-riding phenomenon in terms of stability of the cooperation in the FLOSS community see Osterloh, Rota (2004). Even if between Osterloh and Rota's paper and the present one the converging points are a lot, the view of the authors about the free-riding phenomenon seems to actually be the opposite. Punishment and monitoring are in fact part of the second pillar upon which their argument about FLOSS community sustainability is built. On the contrary, the internalization of rules induced by reflexive identity is consistent with a vision of the community where free-riding has a marginal role, realizing the necessary "conditional cooperation" (the second pillar in Osterloh and Rota's argument) without the enforcement of monitoring and punishment procedures.

O'Mahony (2003), this is true precisely because there is a social mechanism –for example, the reflexive identity- making the individuals internalize the rules of the community.

Summarizing: *being into a community means sharing not only a production process, but also a space in which in every moment individuals are forced by the interaction to share their "vision of the world" with the others, in order to give meanings to the incoming problems the community has to face. But this negotiation of meanings acts-back on one's own vision of the world, and thus on one's identity. This process -that we call "reflexive identity"- produces the internalization of the communitarian space and its rules by the members, making free-riding a less attractive strategy.* The following figure tries to depict all these phases.

Figure 2. The reflexive identity process.



To see this consider the example of a simple user of FLOSS who decides to interact with the community just for a specific need of her, say, fixing her printer. Entering the social environment of the community, however, forces the user to approach a set of visions of the world she did not

consider before, and of whom she was not aware or had just an abstract idea of. The *querelle* between Free vs. Open Source Software advocates can be a good example of this³⁴. Confronting with the others on this issue (whether it is better being open to IPR penetration) strongly affects the vision of the world of the user, who finds herself in need of answering questions and acquiring positions about topics she never thought. These positions do not simply add to the previous set of principles, but interact with it, moving the whole system of values of the user towards another structure. Her identity is then redefined by this new structure, where she cares about the distinction between Free and Open Source Software, and likely takes a position about it, committing her behavior to this new principle and to the community in which it is defined.

The internalization of rules, then, is a gradual process.

First, the individual discovers a “new landscape” of topics and opinions she did not think about before. The topics are determined by the community social environment, i.e. they reflect the dilemmas and the contradictions the community is facing. This means that the landscape is an image of the fundamental points around which the community is evolving, and that is why the newcomer is asked to take a position with respect to them.

Second, in taking a position, the newcomer commits itself to this position. The cost of not being coherent, in fact, is not only the social punishment of the exclusion from the community: it is a cost in terms of internal mismatching of her own identity components. Thus, the individual takes a position and behaves coherently with that.

Third, the specific position itself is to certain extent “irrelevant”. Both sides of the *querelle*, in fact, embody a certain trait of the community, a common set of rules. Whatever position the individual is willing to take, she will commit to a position embodying these rules. Thus, the process of rules internalization does not necessary lead to a *common* vision of the world. Individual A and B can have different opinions and principles before and after the process. Our point is that the process *itself* creates the internalization of the rules because it makes the communitarian debate –the landscape- enters the definition of members’ identities. So it’s the process *itself* that results in a Coordination Game able to move the game from the Prisoners Dilemma’s Nash equilibrium to a Pareto superior one.

With respect to the FLOSS community, this point can be explained recalling again the broad debate around the terms "free" and "open" software. In the literature, the sense of identity is usually

³⁴To have an idea of the importance of this debate consider that in the FLOSS-EU survey (Ghosh *et al.* (2002)) 47% states "I think of myself as a part of the Free Software community", 32% says "I think of myself as a part of the Open Source community" and only 19.38% of the sample do not care. The FLOSS-US survey presents similar numbers: "I identify more with the Free Software community" has been marked by 31.4% of the responders, while 31.5% marked "I identify more with the Open Source Software community" (<http://www.stanford.edu/group/floss-us/>). To explore the terms of the debate, see Giuri *et al.* (2002b), Stallman (1998a) and the web site of the *Open Source Initiative*

attached to the "free" term: members more sensitive to ideological motivations (who do not want any practical compromise with the proprietary regime) are considered more involved in the identity of the community than the advocates of the term "open" (who do care much more about the "segregation" effect induced by the use of the term "free"). Instead, this debate is not among a strong-identity vision and a non-identity one: both positions are part of the debate around the definition of the FLOSS identity. The debate is exactly the process through which the reflexive identity acts at the broad level of the whole community³⁵.

Eventually, notice that this process is not necessarily true for each and every individual joining the community. As Shah (forthcoming) demonstrated, only a subset of developers remains in the community after having achieved their initial goals. Usually these goals are related to the self-supply side of motivations, but the users who remain in the community decide to stay following other incentives, mostly related to a psychological and a social dimension. Notice that these incentives have emerged as new drivers of individuals' behavior because of the experience actors had in the community activity. It is easy to see how this process is consistent with the reflexive identity, which in fact can be seen as the engine driving the described process. But this means that the reflexive identity process is not a process affecting each and every developer entering the community. This is precisely the case. The hypothesis of the present paper, in fact, is that A) *the reflexive identity mechanism is a process endogenously produced in by the actors' interaction*, and that B) *it is strong enough to change the structure of the incentives of the most "reactive" individuals making them internalize the community rules*. The extent at which this mechanism is effective depends on the context of the interaction. What the present paper tries to demonstrate, then, is that this fraction of reactive individuals is large enough to constitute one of the main pillars upon which the community is built³⁶.

4.3. Reflexive identity and the theories of social interaction

Reflexive identity, then, can be considered as a fundamental part of the community engine, together with the other incentives described before. Consider that in the realm of FLOSS the identity concept is not only recognized as important by a certain number of authors (among other, Weber, 2000; Hars and Ou, 2002) but -defined as "reflexive identity"- can be used to bridge the theories analyzed in the previous section.

(www.opensource.org/) and of the *Free Software Foundation* (<http://www.fsf.org>).

³⁵ To have an idea of the terms, the development and the importance of the different debates in the FLOSS community see Weber (2004).

³⁶ This last passage makes clear that the reflexive identity cannot belong to the set of "oversocialized" conception of social interaction (Granovetter, 1985), and instead is perfectly consistent with the "embeddedness" view.

A community of practice is based on negotiation of meanings, where learning reshapes individuals' vision of the world and identity (Wenger, 1998). It is easy to see that the process embedded in the production of the communitarian artifacts is the reflexive identity one. However, there are some fundamental differences. From the previous discussion and from the extensive use of the Wenger's ideas of social interaction, in fact, one could think that reflexive identity is just a different way to reformulate the same ideas embodied in the community of practice. On the contrary, reflexive identity moves along these concepts but it is not bounded by them, because it is originated by what Habermas defines as "communicative interest" (1968).

A community of practice is based on actors' urge to re-establish the coherence of a vision of the world challenged by emerging phenomena. The whole process takes place at the level of the actors' "practical" interaction, i.e. around to and because of the artifact (*sensu lato*) they are collectively producing. "Members of the F/OSS contend the meaning of 'the F/OSS' by programming, contributing codes, reporting bugs, distributing packaged solutions, publishing articles, or simply using a set of software, and in so doing, to make sense of the F/OSS. In this sense, F/OSS is a negotiable idea, not a stable set of artifacts: 'the' F/OSS." (Lin, 2003). In other words, the need for a common understanding of the problem the community is tackling and of the consequent structure of the working practices applied by its members are the engine making the actors' identities converge (Wenger, 1998). The need for this kind of coherence, however, is just a subset of the wider need for reciprocal understanding in a dialogic situation. This wider need has been located and then defined by Habermas (1968) as *communicative interest*.

In order to create our own identity, in fact, we need to see "ourselves from outside". This *immanent* need, i.e. a need which is structural and primary to Man, leads individuals to seek a relationship with others they can use as "mirrors" and criterion for comparison³⁷. This can be done only if individuals constitute a linguistic communication, and thus if they create a common understanding of the language by which they interact. The communicative interest is precisely the need for such understanding. This, in turns generates mutual recognition and legitimation, and in that it is the basis for the communitarian relationship.

The reflexive-identity idea springs from this primary interest, and thus it *comprehends* the community of practice concept. But it widens the basis of the process of identity reshaping, because the engine of this process is a primary need of Man. This widening "frees" our discussion from the practices. The boundaries of the action and of the impulses stimulating the reshaping of the actors' identities are broader than the community-of-practice ones. The action, in fact, is still situated, but only in a linguistic framework, rather than in a specific context.

³⁷ The foundations of this movement are easily recognizable in the movements of the auto-consciences described by

This makes easier to think why a community as the FLOSS one, which is for sure a community of practice (Lin, 2003), is also something more, and is able to create high level of commitment also outside and beyond the practices of software development. In other words, a commitment is created not only at the level of the practices, developing software and working together, but it spreads along every level of the linguistic communication. Every scope of communication relative to the community is the place where collective and individuals' identities are created, and where commitment is developed.

In this, the reflexive identity concept embodies also the "stories-based" concept of identity elaborated by Westenholz (2003), which springs from practices but seems to develop also along other fields of the communicative dimension.

Also epistemic communities (Haas, 1992) are grounded in the reflexive identity. In this kind of community concepts as identity and meanings are considered dependent on the common aim the members want to reach. The collective action becomes just a coordination problem among agents who perceive the other members as "means". To coordinate, however, they must build up a shared code, defining the space of the meanings they have to face, and legitimate a procedural authority to guide the production process. Defining meanings and legitimation are activities which must be grounded on common principles, in order to be accepted by all the members. This common ground is not given at the beginning, and it is not static, but it is endogenously produced and re-produced every moment through the nexus of ties of the community. And this is exactly the mechanism described as reflexive identity. Thus, also epistemic community can be seen as a specific realization of this mechanism.

Consider now the gift economy described by Raymond (1998b). In Raymond's idea, hackers produce code and donate it to compete for *status*. What we observe, then, is a reputation incentive, similar to the recognition-by-peers we find in science (Dasgupta and David, 1994), or as a part of the signaling incentive (Lerner and Tirole, 2002). However, taking seriously this argument, we are forced to ask what reputation is, how it is produced and allocated. A simple answer is that the "quality" of the produced knowledge is judge according to a system of meanings created and debated inside the community. A judgment, in fact, can be done only when a comparison between "what it is" and "what it should be" is possible, and the latter can be defined only with respect to a system of values. Without such a system, the community will be unable to judge the importance of that particular piece of knowledge and the "fairness" of the process through which that knowledge

Hegel (1807) in his *Phenomenology of Spirit*.

has been produced. For the same reason, neither the *allocation* of reputation can be done without that system of meanings. All members must agree on the importance of the prizes through which reputation is allocated, on their meaning, and their "breadth". Reflexive identity, the engine of this system of meanings, is then a central component of all the theories concerning reputation as the gift economy and the signaling hypothesis.

Let us focus again on the gift economy described by Raymond (1998b), and consider the argument from another perspective. A gift carries the risk of not being reciprocated. So the gain from donations must be compared with the expectations relative to others' behavior, and if there is no reason to expect reciprocation, the gift does not take place. But if the donator recognizes that she has some instances or resources in common with other agents, she can try to "force" the *status quo* through the gift. The gift is then a unilateral proposal of cooperation. And it is effective only if it becomes the basis for the construction of a social structure³⁸. In other words, it is able to trigger reciprocity only if it is the first pace along the construction of a group. That is why, anthropologically, the gift is the basis of *societies construction*. When the community is built, moreover, the gift alone cannot keep the social structure "alive". Free-riding, in fact, is always possible³⁹. Again reflexive identity seems to be a good explanation (Berra and Meo, 2001): gifts trigger the construction of a new social structure, in which the reflexive identity process contributes to make members internalize rules and thus to reproduce the community structure.

Following similar steps, it is possible to see how the "general reciprocity" mechanism also needs to be based on the reflexive-identity mechanism. Such a diachronic and asymmetric rule, in fact, must be enforced and preserved through the internalization of the reciprocity rule by the community members. Notice that a mechanism such as the reflexive-identity one is not just a transient or accidental factor in determining general reciprocity. The exchange is only the surface of reciprocity, while its inner structure is instead based on the interaction and the construction of the social relation between the involved actors. Without such a relation, reciprocity becomes a "shaking" concept, always threatened -and thus weakened- by opportunism and free-riding behaviors (Sacco, Zamagni, 2001).

Concluding: reflexive identity can be considered the *trait d'union* between the theories of interaction we have analyzed above.

³⁸This is how communities are created through gifts. See Mauss (1923) and Berra and Meo (2001) for the FLOSS case.

³⁹Sometimes free-riding is considered not attractive just because gifts regard resources (software) which are not scarce (the Raymond's (1998b) "post-scarcity gift economy" hypothesis). However, what matters is the unilateral investment in the construction of social ties. If the gift has no value, donating has no value, and thus the receiver will not consider it as a proposal of cooperation. This argument is directly related to the debate among anthropologists about the relationship gift/scarcity in primitive societies. See a summary of the main positions in Berra and Meo (2001).

4.4. Reflexive identity and the empirical evidences

To “legitimate” reflexive identity a second step is needed: it must be compared with the empirical evidences. As said *identity, learning, creativity*, which can be associated with *fun* (Torvalds and Diamond, 2001), and other *social incentives* seem to be the main categories to which empirical evidences relative to the psychological and social dimension converge. If the reflexive-identity hypothesis is worth as unifying principle, it should be able to capture most of these categories. While it is easy to see that the first and the last categories seem to fit the principle, to assess *learning* and *creativity* some more analysis is needed.

Learning -the most important motivation in a lot of surveys- is a polyhedric phenomenon, which cannot be easily "crammed" into one dimension. Reputation and career concerns are directly connected with learning, as well as self-supply. What we want to stress here is that learning is also strongly “interwoven” with the social dimension of the community, and to the reflexive-identity mechanism. As most of the recent theories of the organization highlighted, learning is in fact a social process, where the system of meanings which constitutes the "knowledge" of the organization is constantly revisited and modified by the action of individuals. How? Independently from the state of the process, on-line or off-line, the learning action is triggered by a "dissonance" between the experience and the established system of meanings (Wenger, 1998). The vehicle of the contradiction is usually the individual, who spreads it along the organizational network. The necessity for a social process aimed to make the system of meanings evolve towards a more solid structure emerges. The inter-subjective dialog and negotiation of meanings through which this process is realized is precisely the reflexive-identity mechanism. To give an empirical foundation to this point of view, consider that in Bonaccorsi and Rossi (2003b) profit-seeking actors as firms are much less interested in learning than developers, confirming that inside *learning* there is an intrinsic dimension which has to be taken into account.

Including creativity directly in the reflexive-identity hypothesis is more challenging. Given the enormous importance of this category (Lakhani and Wolf, 2003), further research is needed on this side. However, some explanation is possible. Raymond (1998c) recognizes that "sense of creativity" in software development has its root in the hacker culture (Himanen *et al.*, 2001). The sense of creativity is then grounded in the culture of a peculiar community, which not only recognizes it as such, but moreover defines it and enforces its definition establishing the parameters to identify “creative software”. As learning, moreover, the source of challenges, proposals, incomplete software and ideas to be explored is the community itself. The creative side of hacking is then fostered and shaped through the communitarian process of reflexive-identity.

Eventually, consider that it is easy to show that other evidences, as the absence of strategic waiting,

the scarce importance of free-riding, the low rate of forking and the "ideological" forking of Gnome, can be explained by the reflexive-identity mechanism. All these evidences, in fact, belong to the realm of intrinsic motivation and express though the communitarian debate, which -in our hypothesis- are shaped by that mechanism.

5. Conclusions

The analysis carried out since here has highlighted three main points. First of all, the empirical studies have shown that the space of the incentives pushing FLOSS developers to write software and to distribute it is wide and polyhedric. Self-supply, signaling and reputation cover part of this space, but they cannot provide a complete explanation for the FLOSS community growth and success. Second, the theories used to cope with the uncovered part of the space are "fragmented", so that a full account of the FLOSS community describes it as a hybrid phenomenon. However, and this is the third point, a common principle connecting these theories and consistent with the empirical analysis can be found. The reflexive identity mechanism, in fact, can be placed at the basis of the theories and combine them –as far as the FLOSS phenomenon is concerned- into a common framework. The result is that the FLOSS community can be described as the structure based on the four "pivots" *self-supply, reputation and signaling and reflexive identity*.

The construction of this three-dimensions model is not merely a descriptive exercise. Placing this analysis into the conceptual framework designed by Dasgupta and David (1987, 1994), it possible to see that understanding what are the basic mechanisms upon which the FLOSS community is built enables us to imagine an "abstract" definition of such a community. Once such an "archetype" is constructed, the conditions needed to create and sustain a community in field other than the FLOSS one can emerge (Osterloh, Rota 2004). At that time, it will be possible to judge the real impact of such an "open" model also outside the realm of software, and to imagine a set of policies helping the economy to "spread" this model along a wider range of knowledge production mechanisms. Strengthen intellectual property rights, then, seems just one of the possible strategies – and maybe not the most efficient one- to cope with the changes induces by the "information age" inside the structure of capitalist societies (Rullani, *mimeo*). As the FLOSS case shows, the ways in which the institutional settings of the economy can be reshaped are a lot. That is why the studies regarding the possibility to spread the "open" model outside the market for software can result in completely new, even more efficient, set of institutions.

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