Motivations for Open Source Project Entrance and Continued Participation

Master thesis, 15 credits, INF M03, in Informatics
Presented in: June, 2013
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Presented in: June 2013

Thesis type: Master thesis

Language: English

Keywords: open source, software developers, self-determination, intrinsic motivation, internalized extrinsic motivation, extrinsic motivation

Abstract

A great number of studies have explored the motivations that drive software developers to devote their time and efforts to contribute to Open Source Software Development (OSSD) projects. Previous studies have stated that both intrinsic and extrinsic motivations are important, however there have been different opinions regarding their relative value. This study further researches OSSD motivations and examines (1) what types of motivations that attract software developers to OSSD projects, (2) what types of motivations that encourage software developers to continue participating in OSSD projects, and (3) how these types of motivations relate to each other in terms of whether some motivations encourage software developers to join and continue to participate in OSSD projects to a higher extent than others, and if the motivations can coexist or crowd out each other. In order to learn more about these questions a web survey measuring different types of motivations (intrinsic, extrinsic, internalized extrinsic) was distributed among developers that contribute to the world's nine largest OSSD projects. Results clearly present similar patterns indicating that OSS developers are highly intrinsically motivated, less internalized extrinsically motivated, and even lesser extrinsically motivated to join as well as to continue participating in OSSD projects. This provides new insights regarding how to treat motivations throughout all phases of OSSD projects. The similarities further strengthen the perception that intrinsic motivations should be prioritized, and thus, since OSS developers are intrinsic by nature, it is important to fulfill developers' intrinsic needs during all phases in OSSD projects. Finally, it can be stated that different types of motivations cannot coexist, intrinsic motivations appear to crowd out extrinsic motivations.

"Really to succeed, we must give; of our souls to the soulless, of our love to the lonely, of our intelligence to the dull. Business is quite as much a process of giving as it is of getting" – *Alice Foote MacDougall* [1]

1 http://quotes.dictionary.com/subject/business?page=6#iTPD6ZlCuPyAxsUe.99

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1. Introduction

This chapter introduces the thesis. It begins by providing a background to the subject-matter leading to the problem area and the relating research questions. The chapter continues with discussing the purpose of the research, and concludes by mentioning research delimitations.

1.1 Background

Open Source Software (OSS) have been successful despite the many doubts about their future survival in the early days of the OSS phenomenon (Lee & Kim, 2013). As users of OSS, in both private and professional contexts, we have often been amazed by the efforts that people put in to provide us with products and services that are free to use, and the range of OSS seems to constantly increase. OSS is defined as "software where users can inspect the source code, modify it, and redistribute modified or unmodified versions for others to use" (von Krogh, Haefliger, Spaeth & Wallin, 2012, p.649).

Despite the fact that media and academia have begun to show a great interest in the OSS phenomenon in the past ten years, the tradition of sharing and cooperation in software development dates much further back (Lerner & Tirole, 2002). During the 1960s and 1970s many of the key aspects of the computer operating systems and the Internet were developed in universities and at corporate research centers. Programmers working at such sites during this period were used to collaborating and sharing source code with each other. Software development projects were often informal and there were no governing licenses which defined conditions for proprietary rights and reuse of software. However, problems soon started to arise in early 1980s when profit-aiming firms began to claim proprietary rights for certain software.

In a response to this issue the Free Software Foundation was founded by Richard Stallman in 1983 (Lerner & Tirole, 2002). The organization aimed at promoting the spreading of free software and an important step in reaching for this aim was to establish a formal license which upheld that developers that intended to contribute to projects governed by the Free

Software Foundation had to agree to make the source code freely available and not impose licensing restrictions on others.

Since the founding of the Free Software Foundation other governing institutions have emerged as a result of a growing OSS community and, consequently, an increasing offer of OSS products (Singh & Tan, 2010). OSS products these days include operating systems (Linux), desktop applications (LibreOffice), web applications and browsers (Apache, Mozilla Firefox), databases (MySQL) and development tools (Perl, Eclipse), indeed products that most software users probably are familiar with to at least some extent. Although such a large number of products have been introduced to the market during the past 20 years attracting millions of users (von Krogh et al, 2012) the basic ideals that identify the OSS phenomenon have remained the same in their essence (Open Source Initiative, 2013). OSS development (OSSD) differs from conventional software development regarding incentives, as well as control and coordination mechanisms (von Krogh et al, 2012).

1.2 Problem area

The OSS phenomenon in general, has been drawing broad attention from academic researchers as well as industry practitioners (Lee & Kim, 2013). In particular, academic researchers from various fields such as management, psychology, and economics, have attempted to reveal the motivations of the individual developers to participate in OSSD projects (Lee & Kim, 2013). OSSD projects are Internet-based communities of software developers who voluntarily collaborate to produce software that they or the organization they work for need (von Hippel & von Krogh, 2003). These projects do not customarily offer monetary rewards since most OSS developers are volunteers who perform their work for free, and many of them agree to have their contributions licensed in such a way that is difficult for them to profit directly from the resulting software product (Benbya & Belbaly, 2010).

Extensive research has identified a broad range of factors that motivate developers to participate in OSSD projects (Agnihotri, Shanker & Kothandaraman, 2012), and the factors have been discussed in relation to different motivational theories (Benbya & Belbaly, 2010). Research on motivation in OSSD presents critical issues regarding contributions to OSSD projects (von Krogh et al, 2012). Motivational factors that have been identified, have usually been broadly categorized into three viewpoints: (1) those who argue that OSSD project

participants are motivated due to intrinsic factors such as fun, kinship and ideology; (2) those who suggest that extrinsic factors, career and pay, are the primary motivational force; (3) the viewpoint that internalized extrinsic factors like reputation and learning mostly motivate OSS developers (Agnihotri, Shanker & Kothandaraman, 2012; von Krogh et al, 2012).

Despite the relatively large amount of previously conducted research, academia is still very far away from fully exploring developers' motivations for contributing to OSSD projects (von Krogh et al, 2012). Some studies have found that OSS developers are mostly intrinsically motivated (Lakhani & Wolf, 2005; Fershtman & Gandal, 2007; Bitzer, Schretti & Schröder, 2007; Osterloh & Rota, 2007), others have stated that extrinsic (including internalized extrinsic) motivations are more important for OSS developers (Lerner & Tirole, 2002; Riehle, 2007; Alexy & Leitner, 2007), and yet others have discussed both simultaneously (Hertel, Niedner & Herrmann, 2003; Krishnamurthy, 2006; Roberts, Il-Horn & Slaughter, 2006; Lee & Kim, 2013). The various foci in these studies indicate that there are disagreements about which motivations OSS developers value the most.

Wu, Gerlach and Young (2007) have investigated OSS developers' intentions to continue their involvement in future projects. There has been research by von Krogh et al (2012) on why developers continue to participate in OSSD projects. Lattemann and Stieglitz (2005) have also identified motivational factors in OSSD in a long term perspective. Baldwin and Clark (2006) discussed how codebases that are more modular or have more option value increase developers' incentives to join and to remain involved in OSSD projects, the purpose of this study was to show that the architecture of a codebase is a critical factor that lies in the center of the OSSD process. Shah (2006) has explored how software developers change during the course of OSSD projects and, with them, how certain motivations evolve over time.

What was however currently lacking in OSSD motivations research was an investigation of what motivates OSS developers to join and continue to participate in an OSSD project, this has not been done in the context of one and the same specific study to enable a comparison that can clearly demonstrate whether the motivations encourage developers to an equal level before and after project entrance. There appears to have been limited amount of studies about how different types of motivations relate to each other before software developers join an OSSD project and after they have joined. More specifically, the interesting question in this context was whether a certain pattern can be found that might reveal if the types of motivations prior to joining an OSSD project are similar, and equally motivating, to the types of motivations that encourage developers to continue to participate and contribute to the project.

Investigating this issue was important because it can provide knowledge abou how to treat motivations throughout all phases of OSSD projects and reveal what is required from recruiters to OSSD projects in terms of their approach to attract and retain software developers. By mainly focusing on motivational types practitioners and academics can get a more sweeping picture of OSSD motivations, informing about what type of personalities that are mostly attracted to join and remain in OSSD projects. The growth of OSS has made it spread outside open source communities to profit-aiming firms, thus there is competition when it comes to both recruiting and retaining developers (von Krogh et al, 2012).

Understanding why developers continue to participate in OSSD is also vital since it indicates if firms and individual OSS users can expect further improvements on the software they are currently using (von Krogh et al, 2012). Some developers tend to unexpectedly change their sharing behavior to gain benefits that suddenly arise (Osterloh and Rota, 2007), and one motivational factor might change overtime as knowledge and experience is created (Roberts et al, 2006). These changes can compose a challenge for stakeholders in OSSD projects.

1.3 Research questions

The discussion above evidently highlights dimensions in OSS motivation research that needed to be further explored. This lead us to the research questions which we intended to investigate:

- What types of motivations attract software developers to OSSD projects? What types of motivations encourage software developers to continue to participate in OSSD projects? How do these types of motivations relate to each other regarding the extent to which they motivate and their ability to coexist?

1.4 Purpose.

The purpose of this study was to find out what types of motivations that attract software developers to OSSD projects and what types of motivations that encourage software developers to continue participating in OSSD projects. The aim was further to find out how these types of motivations relate to each other in terms of whether some motivations encourage developers to join and continue to participate in OSSD projects to a higher extent than others, and if the motivations can coexist or crowd out each other. This shall provide

practitioners and academics with implications about how to reason in the choice of strategies for attracting developers to OSSD projects and motivating them to continue contributing.

1.5 Delimitations

The research was limited to OSSD projects which aim at developing software. Further, the focus was on motivations for software developers exclusively, that is those who are involved in the software development process (requirement analysis, system design, implementation and testing), thus omitting other roles within OSSD projects such as management, training and PR.

2. Theoretical foundation

For the theoretical chapter motivational categories - intrinsic, extrinsic and internalized extrinsic - play a significant part. A review of these concepts and their related motivational factors are presented. At the end of the chapter, a research model is established and arguments of how we reached the model are explained.

2.1 OSS research

OSS communities cannot exist or create value without the contributions of highly motivated developers who spend their time and effort on their projects (Roberts et al, 2006). Motivational factors refer to the different reasons that make individuals motivated to carry out productive work. The reasons why individuals choose to take on a situation or work may vary, and therefore it becomes important to specify how previous studies have approached motivational factors for developers in the open source project.

In order to investigate OSSD motivations before and after project entrance there was a need to first get an overview of motivations that have already been identified in previous studies, then, as a next step, further motivations could be searched for by conducting an empirical investigation. An extensive compilation of OSSD motivations was presented in an article from Von Krogh et al (2012) were the authors reviewed a sample of 40 scientific publications (Appendix A) that deal with motivational factors for OSSD. With a focus on motivational aspects they organized and classified received literature according to topics covered and their theoretical underpinnings. All papers were coded according to motivational factors covered. After merging these together they finally concluded a set of ten different factors related to individual motivation, which in turn were categorized as either intrinsic, extrinsic or internalized extrinsic.

To reduce the risk of overlooking OSSD motivations that might have been discussed in studies that were missed by von Krogh et al (2012), either due to flaws in their search strategy or because there could be studies with later publication dates, further articles dealing with

OSSD motivations were looked for. A search in the EBSCO database for articles containing the keywords “open source”, “motivations”, and “incentives” was performed.

Only studies that deal specifically on the relationship between OSS and motivation, and that had not already been identified by von Krogh et al (2012), were included. This yielded a sample of five additional articles which are presented in Appendix B. Since motivations discussed in the five articles were also mentioned in von Krogh et al (2012) it could be more strongly argued that no motivations which have been identified in studies until current date were overlooked in this thesis.

As previously mentioned in sub-chapter 1.2, researchers have generally categorized different motivations according to Self-Determination Theory (SDT) as either intrinsic or extrinsic (Krishnamurthy, 2006; Ke & Zhang 2006; Benbya & Belbaly, 2010) except the work by Li, Tan, Teo and Mattar (2006) who have classified motivations into types other than intrinsic and extrinsic (Ke & Zhang, 2006). Li et al (2006) proposed a research model that seeks to examine the behavioral effects of OSS leaders on software developers’ motivation to contribute partly grounded on theories of transformational and transactional leaderships. The motivational theory presented in this article was not considered as relevant for the purpose of this thesis since it focuses on the agents that provide motivations rather than the actual motivations. The role of leadership in OSSD projects was not a suitable approach for this study.

Benbya & Belbaly (2010) have also discussed alternative motivational theories - such as Goal-orientation, Expectancy, and Social Exchange - that could be relevant in studies about OSSD motivations. However, theories mentioned here have not been actually applied in the context of OSSD motivations to the same extent as SDT, thus there is less empirical evidence that they can explain the open source phenomenon. Furthermore, these theories lack the breadth that SDT presents in terms of how it explains motivations from several perspectives (intrinsic, extrinsic, internalized extrinsic).

With regards to the arguments presented above this study has come to focus on the three motivational categories from SDT (intrinsic, extrinsic, internalized extrinsic). A presentation of the three categories, which are in the center of the study, together with their respective motivational factors comes next. The categories were kept in the center throughout the thesis to facilitate an observation of clear patterns and find similarities in motivations before and after project entrance. If the study would focus solely on the ten factors, patterns would probably be less clear as an increased number of items to regard logically prompts a more

versatile outline. Still, the ten factors were vital in the sense that they are the building stones of the categories, as is outlined in table 2.1.

Table 2.1 OSSD motivational categories and factors (von Krogh et al, 2012, p 654, modified)

Intrinsic				**Extrinsic**		**Internalized extrinsic**			
Ideology	Altruism	Kinship	Fun	Career	Pay	Reputation	Reciprocity	Learning	Own-use

2.2 Intrinsic motivation

Intrinsic motivation refers to the performance of a certain behavior because the activity in itself is interesting and spontaneously satisfying (Deci & Ryan, 2008). Intrinsically motivated persons aim at attaining positive feelings as a direct result of carrying out an action. Intrinsic motivation is about fulfilling the individual basic needs such as competence, control, joy and autonomy. In this case, its purposes are interesting for one's own sake rather than focusing on a final result or to achieve a goal from an organization (Roberts et al, 2006).

Intrinsically motivated actions are freely engaged out of interest without the necessity of separable consequences (Deci & Ryan, 2000). Intrinsic motivation expresses an inherent tendency to explore innovations and challenges (Ryan & Deci, 2000). It is the path for individuals to perform well and reach their highest potential.

Intrinsic motivation encourages people to extend and exercise their capacities, and obtain new knowledge (Ryan & Deci, 2000). The concept describes a natural inherent desire toward assimilation, mastery, spontaneous interest, and exploration, which is vital for cognitive and social development, and is a main source of vitality and enjoyment throughout life. The postulate of intrinsic motivation assumes that humans are naturally active and have an aim to develop which in itself requires provision to function effectively (Deci & Ryan, 2000). Intrinsically motivated behavior requires optimal challenge. If a task is too challenging for an individual, that person becomes anxious and passive, but if it imposes too less of a challenge the person will get bored and alienated.

According to Von Krogh et al (2012) intrinsically motivated OSS developers' main reason for joining OSSD projects is because of the opportunity to express their creativity and enjoy their

work, where the OSS developers, in turn, will experience a kind of satisfaction and accomplishment. It is these qualities that attract intrinsically motivated developers to OSSD projects.

2.2.1 Ideology

According to Stewart and Gosain (2006) the open source community includes specific norms, beliefs and values that certain individuals have in common and which bind them together, consequently constituting their ideology. The open source community is said to be identified by its common ideology. Norms, beliefs and values are the building blocks of the open source ideology. More specifically, OSS norms state that projects should not be forked, meaning that one project should not be split into two or more projects developed separately (Stewart & Gosain, 2006). According to OSS norms it is also inappropriate to remove a person's name from a project history, maintainer or credits list if that person has not clearly approved to this.

As per OSS beliefs OSSD methods produce code of higher quality than closed source, and there is also a belief that outcomes are better when code and information is available for free (Stewart & Gosain, 2006). Furthermore OSS beliefs state that the more people that contribute to the code the quicker bugs will be identified and solved. It is moreover part of OSS beliefs that practical work is more useful than theoretical discussion, and that status is achieved through community recognition.

The importance of sharing information and helping others is integral to OSS values (Stewart & Gosain, 2006). Technical knowledge, for instance mastering several different programming languages, is highly ranked according to OSS values. OSS values also see a benefit in learning for its own sake, and consider voluntary cooperation to be an important activity (Stewart & Gosain, 2006). Values in OSS also hold that reputation gained by participating in open source projects are valuable.

Several studies in addition to Stewart and Gosain (2006) have discussed ideology as a factor that motivates developers to contribute to OSSD projects. For instance, ideological motives have been presented in David and Shapiro (2008), Yu, Jiang and Chan (2007), and Lakhani and Wolf (2005).

2.2.2 Altruism

In everyday language, altruism occurs when individuals are disposed to sacrifice part of their personal interest in favour of others, it is an honourable gift given without any expectation of future personal reward (Clavien & Chapuisat, 2013). The attributes that commonly define an act as altruistic are that it should be an end in itself and not aiming at any profit (Krebs, 1970). Further it should be performed voluntarily and do well. Being altruistic provides rewards such as boosting one's ego, enjoyment, and community identification. Altruism is a natural part of human nature and is exhibited in some manner by everyone (Baytiyeh & Pfaffman, 2010).

Altruism has been the topic of intense research in many academic disciplines, including biology, psychology, philosophy and economics. However, the term has been used in different ways in order to fit the particular research contexts and needs of each discipline (Clavien & Chapuisat, 2013). In the context of OSSD altruism refers to when participants contribute to a project because they desire to help others by giving something back to the community and help those less fortunate (Baytiyeh & Pfaffman, 2010).

Surveys conducted by Hemetsberger (2004) and Hars and Ou (2002) have shown that altruism indeed motivates developers to contribute to OSSD projects, however the level of impact it has varies between different types of developers. Haruvy, Prasad and Sethi (2003) have stated that in order to minimize the risk of crowding out altruistic motivational factors companies have to manage developers' motivations in a carefully balanced manner.

2.2.3 Kinship amity

According to Zeitlin (2003) it is necessary to understand the concept of kinship amity in order to understand the open source movement. The author applied an analogy arguing that there are no calculated economic relationships within families. It can be considered as a type of gift relationship, however it presents a different type of symbolic capital accumulation to the givers, depending on the variety of kinship system a family belongs to. Family member's give and take in different contexts throughout different stages of life, but no accounts are kept. Similarly, relationships in OSS communities are created through action (Zeitlin, 2003). Kinship structures must hence be considered. On this account each software project is a kin group with an acknowledged leader.

In accordance with Zeitlin (2003), von Krogh et al (2012) have stated that the concepts of

kinship amity and gift economy differ from each other since kinship does not assume interchange in social relations. Likewise it differs from altruism as motivation for contribution since it is restricted to the group to which one belongs, such as the OSS community. Kinship is also an identification of a group which the individuals feel related to, and therefore they are motivated to help people within that group.

Hemetsberger (2004) has found a weak link between kinship and developers' level of contribution. Lakhani and Wolf (2005) have argued against Hemetsberger (2004) and claimed that kinship is an important indicator for contribution especially in the context of time. More authors like David and Shapiro (2008) and Hars and Ou (2002), have stated that there is a connection between number of hours spent and kinship within OSS contribution.

2.2.4 Enjoyment and fun

Enjoyment and fun are central to the concept of intrinsic motivation (Lakhani & Wolf, 2005). Much research has been done confirming that enjoyment and fun motivate developers to contribute to OSSD projects. Shah (2006) has discussed how OSS developers perceive software development as a fun and engaging activity. He found that when writing code, developers were fully engrossed in solving a challenging puzzle. Part of the satisfaction in programming lay in the knowledge that a solution exists and that the solution could be found and implemented with creativity and patience.

Contributors to OSSD project commonly engage in problem solving to create novel code (von Hippel & von Krogh, 2003). One of the most important outputs in this problem-solving process and effort is enjoyment. OSSD can be understood as a by-product of an activity that makes fun and a development model that supports the need for fun in an optimal way (Luthiger & Jungwirth, 2007). Further, the joy of programming does not wear off by time - as the fun factor increases commitment increases equally.

According to Luthiger and Jungwirth (2007) fun as a motivational factor can explain why software developers contribute to OSSD projects for free, holding that they make these contributions in their spare time simply because the unrestrained and open development method is much more fun than creating software under commercial conditions. More specifically, what makes OSSD more fun than commercial software projects is that OSSD projects are driven by a clearer project vision that is usually more convincing, and the developers can control challenges by self–selecting involvement in specific projects so that an

optimal challenge can be derived. Other studies (Osterloh & Rota, 2007; Lakhani & von Hippel, 2003) have reached similar conclusions arguing that fun and enjoyment indeed motivate OSS developers.

2.3 Extrinsic motivation

When people act in order to attain a separable outcome they are considered to be extrinsically motivated (Ryan & Deci, 2000). Extrinsically motivated behaviors are often those which are performed either to obtain a tangible reward or to avoid a punishment (Deci & Ryan, 2008). Extrinsic motivations come from the outside of the environment and the task itself (von Krogh et al 2012). It is usually applied by someone other than the person who is being motivated. Motives which help to solve a problem for personal use or benefit of personal value and that help to increase the status or career opportunities are regarded as extrinsic (Roberts et al, 2006). Extrinsic expectations can provide with continuous extrinsic motivations for the developer when being involved with previously rewarded activities. Extrinsic motivation can enhance the interest in doing a task, to do this the individual makes contributions that in turn can enhance future career possibilities.

Researchers have often operationalized the three motivational categories as mutually exclusive such that a person who expresses high intrinsic motivation has low extrinsic motivation, and vice verse (Hayenga & Corpus, 2010). This is however a constant issue for debate, and some of the more recent studies have held that the different motivational categories actually can coexist and work together to motivate task engagement (Hayenga & Corpus, 2010; Roberts et al, 2006).

2.3.1 Career

The notion of career as a motivational factor is based on the concept that by publishing software that is free for everyone to inspect employers will recognize developers' talent which will increase these developers' value on the labor market (Lerner & Tirole, 2002). The career incentives can be future job offers, shares in commercial open source-based companies, or future access to the venture capital market. Economically oriented OSS developers aim at contributing to high-profile OSSD projects to further their careers leading to more recognition, independence and job security.

Ghosh (2005), Lerner and Tirole (2002), Riehle (2007), and Yu et al. (2007) have all agreed that career is indeed a motivational factor. Hars and Ou (2002) have found a strong relation between paid participants and career as a motivation. Xu et al (2009) stated that motivation of career may help the developers' future work opportunities. Roberts et al (2006) agree with this statement and have claimed that career concerns can also enhance the developer's intrinsic motivations. Contributors who desire to further their careers can in turn enhance their interest in making code contributions because making contributions can also help them achieve higher status or obtain better career opportunities.

2.3.2 Pay

In Lakhani and Wolf (2005) the percent of paid contributors in OSS development were found to be 40%. In their study 87% of all respondents reported receiving no direct payments, however 55% contributed code during their work time. Moreover, 38% of the sample stated that their supervisor was aware that they contribute to an OSSD project during work time and 17% indicated that they avoid official job tasks provided by their employer while working on the project. Those who received direct financial compensation and whose supervisors knew of their work on the project represented approximately 40% of the sample. This result was consistent with the findings from other similar studies (Hars and Ou 2002; Hertel et al, 2003).

Payment affects total motivation in general, and in distributed innovation settings such as OSSD projects in particular (Alexy & Leitner, 2011). Monetary reward in OSS has positive effects on the developers, as long as the payment was not strongly expected. If payment is expected it will no longer be able to positively affect the individuals' total motivation. Hence, individuals who do expect payment to begin with will not be additionally motivated by such incentives. While payment may initially cause positive direct effects, in the long run, it may become expected and thus lose its potentially motivating effect.

2.4 Internalized extrinsic motivation

Between intrinsic and extrinsic motivations stand a number of other motivations which can be defined as a mix of both (Deci & Ryan, 1987). They are not intrinsic at the outset, but undergo an internalization process that moves them away from strictly extrinsic motivation. Deci and Ryan (1987) have referred to these motivations as internalized extrinsic motivations.

In a research carried out by Deci and Ryan (2008) the authors have mentioned three types of internalization that differ to the degree of which regulations become integrated with a person's sense of self. *Introjection* is the first type of internalization of regulation. This term is described as the least effective internalization because it involves taking an external demand or regulation but not accepting it as their own. Instead it remains somewhat alien to people and tends to control them much as it did when it was still external. In this type, ego, such as pride and self-esteem, is more controlling to the individual, as well as guilt and shame after failure.

The next type described is *identification*, which explains how people accept the importance of a behavior for themselves and thus accept it as their own (Deci & Ryan, 2008). When this is identified with regulation the individual feels less controlled and more autonomous and does not feel pressured to perform the behavior.

The third type of internalization is *integrations* which represents the fullest type of integration. This term refers to when individuals identify the aspects as their true integrated self. They assimilate a new identification with who they are. Roberts et al (2006) state that internalized extrinsic motivation based on the interjection, which basically is an ego uplifting motivation for the task, tends to minimize intrinsic motivation. Despite that reputation may be created among these developers, the developers become less self-regulated. However, Raymond (2000) has stated that internalized extrinsic motivations can be an important indicator in contributions to OSSD projects because it can be seen as a move to enhance career possibilities.

2.4.1 Reputation

Reputation in OSSD can be classified into two distinct sub-categories: peer reputation and outside reputation (von Krogh et al, 2012). Peer reputation is aimed at colleagues inside the open source community as well as potential employers who identify skilful developers by their reputation. Outside reputation, on the other hand, deals with expected reactions to the developers by important external stakeholders (outside the open source community), and prestige awarded (von Krogh et al, 2012).

A large number of previous studies around OSSD motivations have centered around peer reputation. Lerner and Tirole (2002), Hertel et al (2003), and Lakhani and Wolf (2005) have conducted studies that demonstrate developers' aim to gain both peer reputation and outside reputation by contributing to OSSD projects.

According to Lakhani and von Hippel (2003) peer reputation motivates developers to perform technical tasks but does not drive them to perform ordinary routine tasks which in fact are of equal importance. Lattemann and Stieglitz (2005) have stated that programmers are motivated by peer reputation to a much higher extent than managers and bug fixers. According to Spaeth, Haefliger, von Krogh and Renzl (2008) higher levels of contribution makes developers gain more peer reputation. Furthermore, Roberts et al (2006) have shown that developers who are motivated by reputation are more likely to get their code contribution accepted in OSSD projects.

2.4.2 Gift economy/Reciprocity

Open source gifts are similar to traditional commodities and can be used as both a product and a gift for creating and maintaining relationships (Bergquist & Ljungberg, 2001). Gift giving in OSSD communities takes place in a world of information instead of a world of objects or artifacts. There is no formal obligation to pay back, however there is a moral obligation to pay back in the form of having some solidarity to the community. This can be expressed by praising the software, the project owners and the major contributors. OSSD can be regarded as a form of gift economy meaning that developers give code to others and expect to receive gifts in return (von Krogh et al, 2012). Under the definition of internalized extrinsic factors the concept of gift economy can be labeled as reciprocity (interchange).

Developers that share gifts in an OSSD project need to trust each other (Bergquist & Ljungberg, 2001). Giving away the best piece of code a person has produced demands strong social ties between the giver and the receiver. The receiver must appear as trustworthy, otherwise the giver will not give away his code. At the same time, the demands for high-quality source code give the project owner the moral right to judge whether a contribution has high enough quality to be considered as part of the final distribution. It becomes important for the receiver to be trustworthy in the eyes of the givers (Bergquist & Ljungberg, 2001). Virtual collaboration and gift giving must thus be based on trust in order to make criticism regarded as something that can contribute to the overall quality of the products.

Hemetsberger (2004), Lakhani and Wolf (2005), and David, Waterman and Arora (2003) have presented reciprocity as a motivation for contribution to OSSD, however the level of effect it has differed. It has also been suggested that reciprocity motivates developers to perform simple everyday tasks in particular (Lakhani & von Hippel, 2003). Furthermore, Lakhani and

von Hippel (2003) have expressed a perception that developers who have previously been helped by their community peers are more prone to exchange gifts in the course of gaining new skills and experience.

2.4.3 Learning

Authors have tend to define the concept of learning rather vaguely (von Krogh et al, 2012). Most often learning has referred to the process of learning from the experience of writing software and the feedback provided by peers who inspect the code (von Krogh et al, 2012). Von Hippel and von Krogh (2003) and Yu et al (2007) mentioned how important it is for developers to follow and learn from scripts even though it takes time. However this precious time will be important if the developers want to advance to community leadership or other central positions. Ghosh (2005), Hemetsberger (2004), Lakhani and Wolf (2005), Roberts et al. (2006), and Hars and Ou (2002) have confirmed that learning motivated individuals to participate.

Spaeth et al (2008) have discussed learning in terms of learning opportunities which are represented by access to software source code, to experts in a very specialized field, to technical discussions with peers, or to direct feedback. They argued that the amount and the quality of the learning opportunities increase with the individual involvement in the project. Developers motivated by learning are expecting to learn something new instead of discussing the same idea and solution repeatedly (Yu, Jiang and Chan, 2007). When an issue that is perceived to be novel arises, members' expectation of learning new knowledge is more likely to happen and their active learning motivations are increased.

As the level of involvement varies a variety of learning opportunities are available to OSSD project participants (Spaeth et al, 2008). There are passive and feedback learning opportunities that in turn have different levels of quality. An expert replying to a technical question represents a higher quality learning opportunity than an unqualified comment. There is a positive relationship between involvement and learning opportunities. Only interaction between participants in OSSD projects can generate direct feedback from a large number of contributors.

2.4.4 Own-use value

One reason why OSS has become an attractive alternative to commercial software is because

it enables the users to adapt and improve the software according to their personal needs (Hertel et al, 2003). Own-use value relates to the creation of OSS for contributors' personal use (von Krogh et al, 2012). OSSD projects can arise to satisfy a need and fill an unfilled market (Wu et al, 2007). Software developers often decide to launch OSSD projects initially because they are in need of a program to perform a certain function but have not found a program that fulfills their needs. Usually, OSS developers can modify the OSS to suite their own requirements, or the requirements of the business that lead the project.

Surveys by David et al (2003), Ghosh (2005), Hars and Ou (2002), Lakhani and Wolf (2005), and Hemetsberger (2004) have pinpointed own-use value as a motive for participating in OSSD projects. Lakhani and von Hippel (2003) ascertained that own-use value motivates developers to perform ordinary routine tasks. In coherence with these findings Lattemann and Stieglitz (2005) have stated that contributors who revise bugs are motivated by own-use value in particular.

2.5 Theoretical framework

Sub-chapters 2.2 to 2.4 have presented motivational factors in OSSD. The three categories - intrinsic, internalized extrinsic and extrinsic - have been outlined, together with a more detailed discussion of the ten motivational factors which coincide with the three categories. The motivational factors have been mentioned individually since they can be regarded as the building blocks of the categories. However, the focus of the research was on the three categories and how they motivate developers to enter and continue to participate in OSSD projects, respectively.

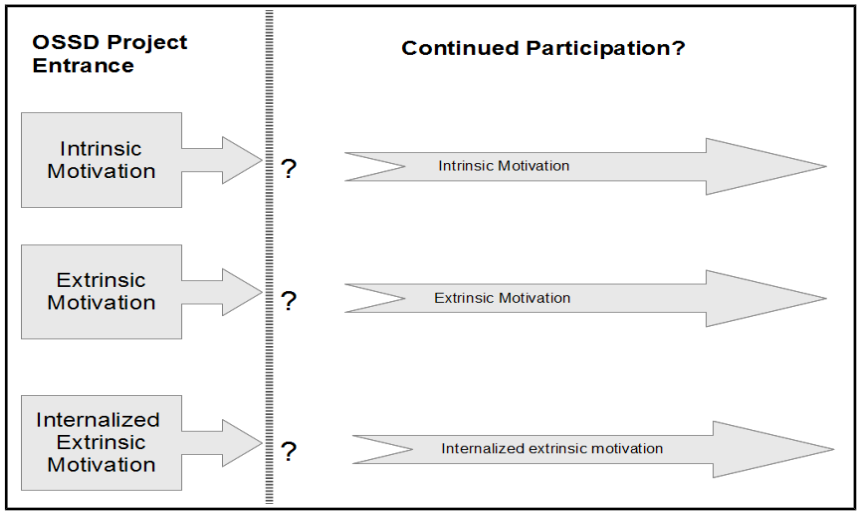


Figure 2.1 -Proposed motivations before project entrance and continued participation

Figure 2.1 presents the three motivational categories which have been discussed in sub-chapters 2.2 to 2.4. As was argued in sub-chapter 1.2, there was uncertainty concerning what the specific motivations for OSSD project entrance were and what the motivations for continued participation in OSSD projects were. Furthermore, the question was how these motivations relate to each other in terms of whether some motivate developers to join and continue to participate in OSSD projects to a higher extent than others, and if they can coexist or crowd out each other. It was thus our task to conduct an empirical investigation to explore these issues.

3. Research methods

This chapter provides an explanation regarding the data collection for the investigation of the study. First there is a description of the choice of method (3.1) which discusses the approach used for data collection. After that, the population (3.2), which was the target group, and the design of the survey (3.3) are explained. Finally reliability, validity (3.4) and ethics are brought up as well as bias that may have influenced the choice of method.

3.1 Method selection

The aim of our study was to find out which types of motivations that attract software developers to OSSD projects and which types of motivations that encourage software developers to continue participating in OSSD projects, and explore how these motivations are associated. Since, as already mentioned in sub-chapter 1.2, different findings in previous studies indicate that there are disagreements about to what level motivations encourage OSS developers, it had to initially be determined if motivations, which have already been identified and discussed in sub-chapters 2.2 to 2.4, actually have a role in motivating developers to join and continue to participate in OSSD projects. It was therefor necessary to examine every motivational factor and determine to what extent they motivate OSS developers before and after project entrance, respectively.

In addition to this, further motivations were to be searched for to find out whether previous studies have overseen some motivations. As discussed in sub-chapter 2.5, the motivational categories, in relation to their respective motivational factors, were rather well established, however we still decided to inquire informants for further motivational factors since it might yield some useful data. We could not rule out the chance that motivational factors, or perhaps a new dimension of a factor, has been disregarded by existing literature. This should lead to a comprehensive compilation of motivations for joining and continue to participate in OSSD projects. These findings would in turn enable ways to examine how these motivations relate to each other.

We have intended to focus on motivations from developers' perspective, thus targeting a large population to be able to generalize our results. In our choice of method we put consideration in judging whether it would be feasible to conduct a survey with regards to the purpose of our study, as well as available resources (Sapsford, 2007). Considering the conditions described above we found a web survey to be most appropriate. Applying this approach enabled us to gather enough data to be able to, at some extent, generalize our findings. As a quantitative method, survey research has increased our opportunities to collect data from a more diverse set of informants, simply because of the larger number of respondents.

We also maintain that, in our context, a survey research offered a desired amount of flexibility and efficiency in the sense that once the survey had been distributed informants could answer at any time they wished, and at the same time our research became less limited in time and space. This also brought us the advantage of being able to refine previous chapters in the thesis while awaiting informants' responses to the survey.

3.2 Sample population

We aimed at gathering a sample of respondents which can be considered representative of OSS developers to the highest possible extent. This ambition of an increased population validity (Sapsford, 2007) was partly halted by the difficulty of defining a representative sample of OSS developers, as also noticed by Ghosh (2005).

The impression that there was not enough empirical data on OSS developers to determine a specific sampling criteria implied that it was very hard to sample developers and be confident that the distribution of age, gender, nationality, and other demographic metrics alike, was representative of the distribution in the total developer population which was unsampled (Ghosh, 2005). The effect of this choice might have been a decrease in (population) validity, however overall we hold that this did not affect the quality of our study since the research question solely implied a focus on the similarities between motivational factors prior to and after project entrance, and not a focus on differentiating between age groups, men and women, and other such characteristics.

In our decision of which forums to post the survey on we decided to mainly focus on the largest OSSD projects as established by Ingo (2010). We primarily searched the Internet for

forums related to the following communities: Linux/GNU, KDE, Apache, Perl CPAN, Mozilla, Gnome and Eclipse, which are outlined in table 3.1. This brought in developers' different perspectives to participate, thus forming the result from their various experiences and viewpoints coming from different communities.

Table 3.1 – Communities used for data collection

Community	Service	URL
GNU/LINUX	Operating system	http://www.linux.se/forum/ http://www.linuxforum.com/forum.php
KDE	Graphical desktop	http://forum.kde.org
Apache (ASF)	Webb-server	http://www.apachelounge.com
Eclipse	Tool-set for development	http://www.eclipse.org/forums
Perl CPAN	A family of high-level, general-purpose, interpreted, dynamic programming languages	http://forums.worldofgnome.org
Mozille	Software community	https://forums.mozilla.org/addons http://forums.mozillazine.org/index.php?c=4
Gnome	Desktop environment	http://forums.worldofgnome.org
Drupal	Content management system	http://drupal.org/forum
OpenOffice	Office productivity software suit	http://forum.openoffice.org/en/forum

In addition to these nine communities there were other communities which contributed to the results of the survey, however these were smaller OSSD sub-projects that actually pertain to the nine larger projects. In some cases no official unifying forum was available for spreading the survey, and in those cases we had to either look for a forum related to such sub-projects or contact the community by other means (mainly e-mail).

The fact that the survey was distributed through these communities limited our sampling process, which was a necessity since it would not be possible to identify every forum in all OSSD projects globally. However, it did not directly limit our sample because an OSS developer who works on an OSSD project other than these could still enter one of these forums, fill out the survey and then be included in the sample. With the ambition to increase the number of respondents we also spread the survey through some forums of a more general character.

3.3 Survey design

An electronic survey was selected to collect data from respondents (the complete survey is found in Appendix C). Using Google forms as a tool, we aimed at a minimalistic design and a clear structure to decrease respondents' efforts and decrease harm in accordance with proper ethical conduct, as is further discussed in section 3.5.4. The survey used colors sparsely and applied different font sizes solely with the purpose of distinguishing headers, questions, answers and explanatory text. We also decided to keep the full survey within a single page so that it could be easily over viewed, splitting it up in different sections could have increased the risk of informants aborting before completion because of an uncertainty about how much that was remaining. To further encourage respondents to complete the survey, questions were expressed in the most compressed manner possible without compromising on clarity.

The survey begun with a short introductory text which briefly presented the background of the thesis and its purpose. It further informed about the length of the survey and stated that information about respondents was kept confidential. The intention with this section was to signal the importance of the study in order to encourage participation, and also ensure that standard ethical practices were applied. The introductory text was also included as part of forum posts, however in slightly modified versions customized to suite the different communities.

The first two questions of the survey were filter questions. These were included to certify that respondents were part of our target group, thus we needed to check that they (a) were participating in a project which was defined as open source, and (b) have the role of software developers. Only one project, the most significant project, was to be be chosen in question number one. The purpose with this limitation was to make sure that the respondent had selected only one project to base their answers on when subsequent questions were to be asked. The idea with the third question was that by making people remember the date they joined the project it could set respondents minds back to the time they joined the project and therefore helping them to answer the ten questions that followed more accurately.

In a general sense, the three initial questions could serve a purpose as warm-up questions to help respondents set their minds on a proper tuning. After the three opening questions came 20 question using Likert scaling. The first ten of these were thought to explore to what extent the ten motivational factors motivated the respondent to join the referred project, thus relating to the first research question. The next ten questions aimed at inquiring about how much the

ten factors motivate the respondent to continue to participate in the project which was intended to provide data for the second research question. The idea was that the motivational factors could be grouped together in their respective categories and then a comparison could be made between motivational categories prior to project entrance and within project continuance. The relationship between survey questions, motivational factors, motivational categories and project entrance/continued participation are outlined in figure 3.1.

Question number	Question	Factor	Category	Before project entrance	After project entrance
4	To what extent did your personal ideology initially motivate you to join the project?	Ideology	Intrinsic	✓	
5	To what extent did the oppurtunity to voluntarily do good for others without personal gains initially motivate you to join the project?	Altruism	Intrinsic	✓	
6	To what extent did the thought of belonging to a community initially motivate you to join the project?	Kinship amity	Intrinsic	✓	
7	To what extent did the opportunity to enjoy yourself and have fun initially motivate you to join the project?	Enjoyment and fun	Intrinsic	✓	
8	To what extent did the possibility of earning a reputation initially motivate you to join the project?	Reputation	Internalized extrinsic	✓	
9	To what extent did the opportunity to receive gifts initially motivate you to join the project?	Gift economy/reciprocity	Internalized extrinsic	✓	
10	To what extent did the opportunity to learn initially motivate you to join the project?	Learning	Internalized extrinsic	✓	

11	To what extent did the opportunity to use software for your own purposes initially motivate you to join the project?	Own-use value	Internalized extrinsic	✓	
12	To what extent did future career opportunities initially motivate you to join the project?	Career	Extrinsic	✓	
13	To what extent did monetary rewards initially motivate you to join the project?	Pay	Extrinsic	✓	
14	To what extent does your ideology motivate you to remain in the project?	Ideology	Intrinsic		✓
15	To what extent does the will to do good for others without personal gains motivate you to remain in the project?	Altruism	Intrinsic		✓
16	To what extent does the feeling of belonging to a community motivate you to remain in the project?	Kinship amity	Intrinsic		✓
17	To what extent does enjoyment and fun motivate you to remain in the project?	Enjoyment and fun	Intrinsic		✓

18	To what extent does reputation motivate you to remain in the project?	Reputation	Internalized extrinsic		✓
19	To what extent do gifts motivate you to remain in the project?	Gift economy/reciprocity	Internalized extrinsic		✓
20	To what extent does learning motivate you to remain in the project?	Learning	Internalized extrinsic		✓
21	To what extent does the use of software for your own purposes motivate you to remain in the project?	Own-use value	Internalized extrinsic		✓
22	To what extent do career opportunities motivate you to remain in the project?	Career	Extrinsic		✓
23	To what extent do monetary rewards motivate you to remain in the project?	Pay	Extrinsic		✓

Figure 3.1 – OSSD motivational Factors & Categories

In our use of Likert scaling we opted for even numbers, which forced respondents to express some kind of preference instead of picking a neutral midpoint (Sapsford, 2007). We found this suitable because OSSD offers such a unique approach to software development that the decision to join a project surely demands relatively high self-awareness. The survey concluded with two more open-ended questions which let informants express in their own words what motivated them to join the project and what motivates them to remain respectively. As mentioned in chapter 3.1 we could not be fully confident that all motivational factors had been covered, and if some supplementary factor(s) were to be mentioned repeatedly it should be added to the appropriate category, and might open up for further discussion.

3.4 Reliability and validity

To analyze the data we used the mean as a value for comparing the motivational groups and to see the similarities. The choice of using surveys rather than other methods possibly had a positive impact on the accuracy of the study. As mentioned in sub-chapter 3.1, online based surveys makes it possible for respondents to answer whenever they want to. For this reason there was a reduced likelihood that the participants were affected by each others' answers because they had the chance to answer in privacy wherever and whenever they wanted. What may have influenced the study negatively on the other hand was that we did not have the opportunity to be present to verify that answers were only submitted by one individual.

To increase the external validity in our survey we put our survey where the population existed, namely in the forums. Furthermore, all questions in the survey have been carefully thought through and adapted to the study. This was needed in order to assure that the answers are not affected by factors other than those which we are trying to measure (Sapsford, 2007). No questions were changed or varied depending on the groups or projects that the questionnaires was sent to.

3.5 Bias

During the data collection it was important to avoid any biases from respondents which could have an impact on responses. To eliminate bias data was collected from several and different

open source communities around the world.

These communities manage projects which, though they are all open source, differ in features such as scope, audience, developer community, and programming language. Hence, it can be concluded that the research was not directly biased towards one single group of developers.

3.6 Ethics

Prior to the design of the survey and the quantitative study of respondents, ethical issues have been taken seriously, and we have taken consideration of this by giving the respondents the opportunity to privacy and anonymity, which was described in the questionnaire. It should also be noted that it was optional for respondents to answer the questionnaire. Before the sending of questionnaires we gave a description of the study on the various forums that the survey was directed to and the description including the purpose of the survey and what the respondent's consequence of contribution can provide, as has also been recommended by Israel & Hay (2006) who argue that it is important to explain for respondents what the meaning and purpose of the survey is.

4. Empirical investigation

This chapter first discusses the data collection process and respondent selection (4.1). After that survey results are presented (4.2).

4.1 Survey sample

The survey distribution process went on for 10 days. During this period a link to the survey was shared at different forums and through developer mail lists which we signed up for. This finally rendered a total of 96 respondents, of which 11 respondents were later excluded from these 96, the reason for this is discussed in paragraph three as follows. The response rate was initially very low, averaging around 5-10 responses per day during the first six days. On the seventh day the number increased dramatically to 25 responses, but then it fell again to approximately the same rate as previously recorded. Because of the decrease no further responses were accepted, the supposed advantages with a continued data collection process was not in proportion with the needed efforts. Figure 4.1 depicts the distribution of developers between OSS projects. GNU/Linux was the project with the largest number of developers, which was not unexpected since, as stated in sub-chapter 3.3, it is the world's largest OSSD project.

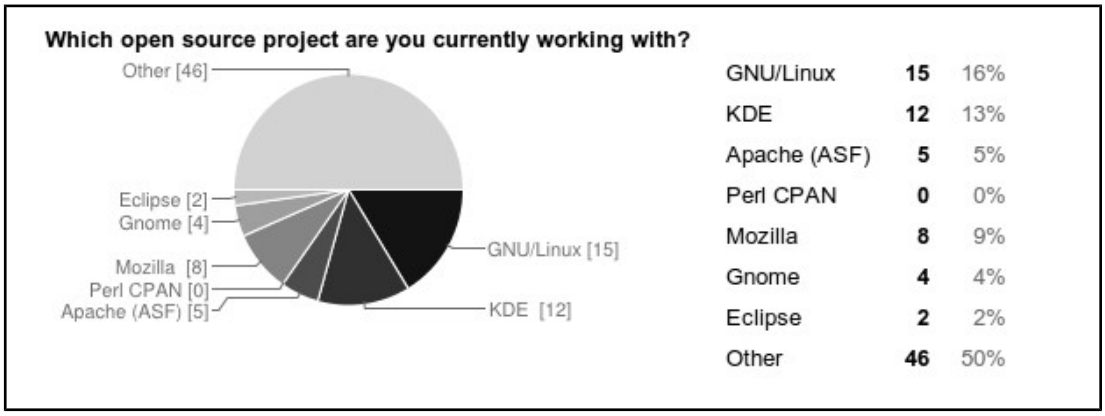


Figure 4.1 – OSSD project appurtenance

As presented in figure 4.1, 50 percent stated that they participated in a project other than the available options, however, despite this large portion none reported to be contributing to a project which was not open source per definition. In many cases projects in the “other” category were in fact part of one of the larger projects from the available options, the most common one (6 %) being the Fedora project which develops an OS built on the Linux kernel. The amount of time spent in a project (question 3) spanned from 3 months to 43 years, all dates are presented in Appendix D.

The second filter question (survey question number two) led to the exclusion of four respondents who were not participating in the software development process (figure 4.2). In addition to these, seven others were omitted because there were clear doubts about their sincerity, either they had not answered all questions or they had left unpleasant comments which were irrelevant to the questions. After these filtering the sample used for calculations finally consisted of 85 respondents.

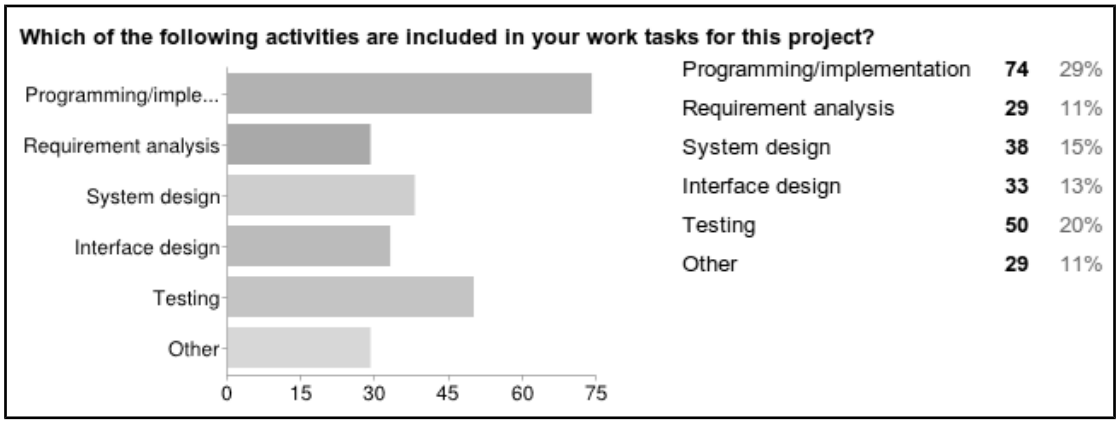


Figure 4.2 – OSSD project tasks

4.2 Survey results

Results from questions relating to respective motivational factor and motivational category are presents in table 4.1. The table includes results for motivational factors that excelled with very high or low values. As mentioned earlier (3.2) the purpose was to depict how the questions provide a means for measuring the impact of the motivational factors which are the building stones of the motivational categories which in turn are the focus of the study. The table presents mean value and median value for each question. Complete survey results are presented in Appendix D.

It can be observed in table 4.1 that learning was the individual factor that presented the highest values both before and after project entrance. Within the intrinsic category all factors motivated developers to join OSSD projects to a high extent, however kinship amity had slightly lower values. It can further be noticed that pay does not seem to motivate developers to join OSSD projects to a high extent nor does it motivate them much to continue to participate.

Table 4.1 – survey results

Question number	Question	Factor	Category	Before project entrance	After project entrance	Mean	Median
4	To what extent did your personal ideology initially motivate you to join the project?	Ideology	Intrinsic	✓		4.64	5
5	To what extent did the oppurtunity to voluntarily do good for others without personal gains initially motivate you to join the project?	Altruism	Intrinsic	✓		4.35	5
6	To what extent did the thought of belonging to a community initially motivate you to join the project?	Kinship amity	Intrinsic	✓		3.77	4
7	To what extent did the opportunity to enjoy yourself and have fun initially motivate you to join the project?	Enjoyment and fun	Intrinsic	✓		4.76	5
9	To what extent did the opportunity to receive gifts initially motivate you to join the project?	Gift economy/reciprocity	Internalized extrinsic	✓		1.75	1
10	To what extent did the opportunity to learn initially motivate you to join the project?	Learning	Internalized extrinsic	✓		5.1	5
13	To what extent did monetary rewards initially motivate you to join the project?	Pay	Extrinsic	✓		2.24	1
16	To what extent does the feeling of belonging to a community motivate you to remain in the project?	Kinship amity	Intrinsic		✓	4.14	5
19	To what extent do gifts motivate you to remain in the project?	Gift economy/reciprocity	Internalized extrinsic		✓	1.80	1
23	To what extent do monetary rewards motivate you to remain in the project?	Pay	Extrinsic		✓	2.46	2

Table 4.2 shows mean, median and modal values for respective category prior to project entrance. The standard deviation is also presented. Observing the mean values there was a

clear pattern that before entering an open source project software developers were highly intrinsically motivated (4.38) but much less extrinsically motivated (2.94). Internalized extrinsic motivations lay in between (3.72). Median and themode values present a similar pattern with declining values going from intrinsic to extrinsic via internalized extrinsic.

Table 4.2 – OSSD motivations before entrance

	Mean	Median	Mode	Std deviation
Intrinsic	4.38	5	6	1.58
Extrinsic	2.94	2	1	1.90
Int. extrinsic	3.72	4	6	1.94

After having joined an OSSD project informants stated that they were still intrinsically motivated to a high extent (table 4.3). The relationship between categories was similar to the one observed in table 4.2, with intrinsic motivations having the highest values followed by internalized extrinsic, then extrinsic. The mean value for intrinsic motivations (4.53) was higher than the observed mean value for internalized extrinsic (3.70) as well as extrinsic motivations (3.18).

Table 4.3 – OSSD motivations after entrance

	Mean	Median	Mode	Std deviation
Intrinsic	4.53	5	6	1.53
Int. extrinsic	3.70	4	6	1.92
Extrinsic	3.18	3	1	1.89

The pattern similarity was further confirmed by a comparison between figure 4.3 and 4.4 below. The pie charts present the division between the categories expressed in percent, with a higher percentage rate indicating that the category motivates software developers to contribute to OSSD projects to a high extent.

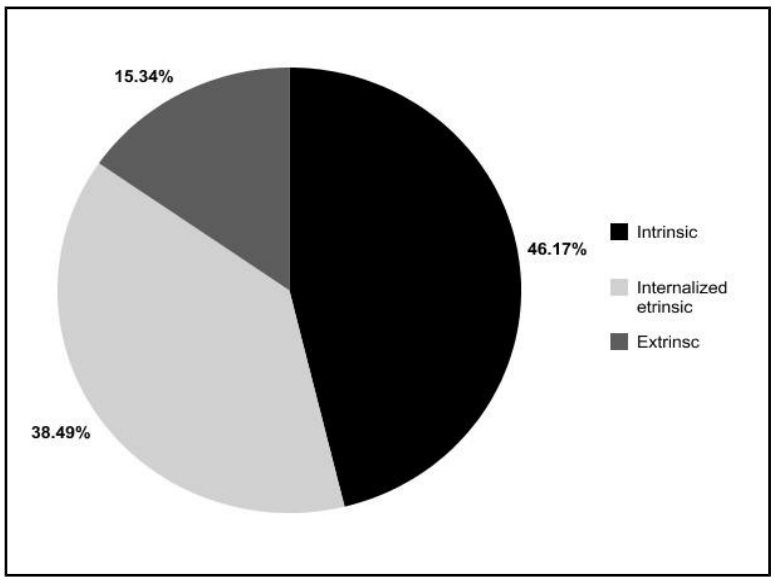


Figure 4.3 – OSSD motivations before project entrance

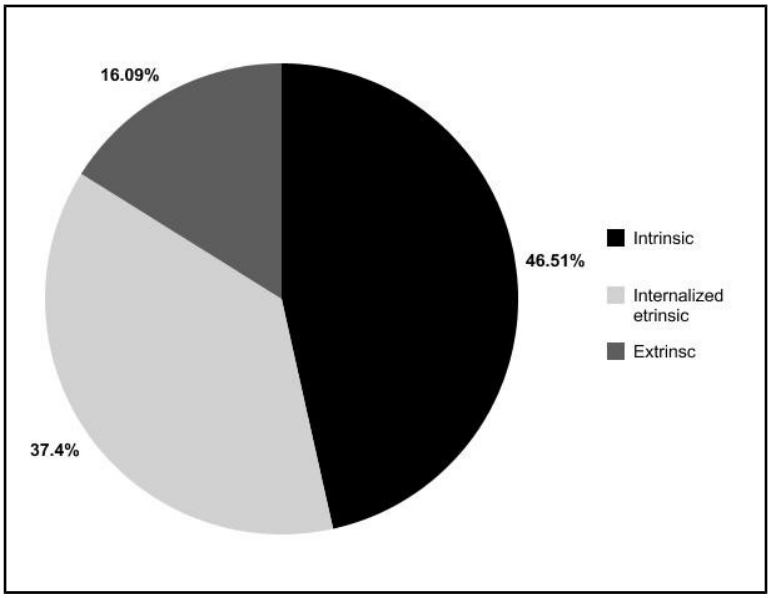


Figure 4.4 – OSSD motivations after project entrance

5. Analysis

This chapter further analysis results from the empirical investigation. The results are discussed in relation to other studies in the OSSD motivations field.

5.1 What attracts developers to OSSD projects?

OSS developers stated in the survey that what attracted them to enter an OSSD project were mostly the intrinsic motivations. The mean value (4.38) was not very far from the highest value on the Likert scale (6) and points towards a conclusion that motivational factors within the intrinsic category motivated OSS developers to join OSSD projects to a high extent.

This means that before entering the projects they expect to attain positive feelings as a result of their contribution (Deci & Ryan, 2008). This also implies that developers join OSSD projects because the purposes of these projects are interesting for their own sake, it is the journey they appreciate rather than achieving a final result (Roberts et al, 2006). What these numbers further pointed to is that a certain type of individuals are attracted to OSSD projects. Since the intrinsic category presented such high values before project entrance, those who seek to join these projects are most probably the kind of individuals who on a general level look to attain inner fulfillment in life, thus these are the people to look for when recruiting developers.

Among the motivational factors within the intrinsic category prior to project entrance, kinship amity was the one that had a slightly lower mean value (3.77). The other three factors (ideology; altruism; enjoyment and fun) all had mean values higher than four. It can then be argued that when looking to recruit intrinsically motivated developers, all four factors should be present as incentives to developers, but if prioritizing is necessary there can be less focus on making developers feel like they belong to a community.

With the mean value 3.72 developers are internalized extrinsically motivated to a lesser extent than they are intrinsically motivated, but to a higher extent than they are extrinsically motivated to join OSSD projects. Compared to the other two categories, the internalized extrinsic category was however more difficult to analyze since it was the most fragmented one. Considering the range of the Likert scale (1-6) the standard deviation (1.94) was relatively high.

Moreover, the internalized extrinsic category comprised the two single motivational factors with the highest as well as the lowest mean value before project entrance. Learning had the mean value 5.1 and gift economy/reciprocity had the mean value 1.75. An explanation for this high dispersion might be that internalization can happen on different levels, extrinsic factors are more or less internalized (Ryan, 2008). It is likely that learning has reached the third type of internalization, integrations, and as such is very close to being an intrinsic factor, which in turn explains the high mean value. Likewise, gift economy/reciprocity might have only reached the level of introjection, hence being of a more extrinsic nature and, as is stated in the following paragraph, OSS developers are not highly extrinsically motivated when looking to join an OSSD project.

Extrinsic motivations did not encourage developers to join OSSD projects to a high extent, the mean value for the extrinsic category was 2.94. The value was distinctly lower than the value for the intrinsic category. The value reveals that developers do not decide to become contributors to OSSD projects primarily because they hope to obtain a tangible reward. The reason for this can be that this is a part of OSS developer's personality, they are more intrinsically than extrinsically oriented. The characteristics of OSSD - source code available, software free of charge, voluntary project participation (Hars & Ou, 2002) - most surely attract a certain group of people who find these working conditions appealing. This can possibly explain why the extrinsic category presented such low values in comparison with the intrinsic, OSSD projects in themselves can be defined as intrinsic rather than extrinsic, they seem to fulfill intrinsic purposes.

In studying how motivations evolve over the OSSD project life-cycle, Shah (2006) has pointed out that developers are mostly internalized extrinsically motivated before they enter OSSD projects, and that intrinsic and extrinsic motivations initially motivate developers to a lesser extent. In this sense findings from Shah (2006) partly disagree with results from our study, since we have found that OSS developers are highly intrinsically motivated before they join OSSD projects, while Shah (2006) has argued that they only become intrinsically motivated when remaining in a project.

The differences between our studies concerning intrinsic motivations can be due to the different research methods, where Shah (2006) applied open interviews and did not inquire about motives directly, driving respondents to put forward motivations themselves. The case might then be that respondents failed to realize the importance of intrinsic motivations because these motivations are inherent (Ryan & Deci, 2000) and as such less explicit, developers might thus initially be less aware of their role and it was hence not the motivations that first stroke their mind.

Findings from Shah (2006) comply with our results concerning the lesser importance of extrinsic motivations prior to OSSD project entrance. The fact that our study, in accordance with Shah (2006), has found that OSS developers are not extrinsically motivated to join OSSD projects makes a stronger case for this viewpoint, moreover studies about OSSD motivations generally have tend to emphasize extrinsic motivations less (von Krogh et al, 2012).

5.2 What encourages OSS developers to remain in OSSD projects?

The relationship between the three motivational categories after project entrance very much resembles the one observed prior to project entrance, this pattern similarity is illustrated in figure 5.1. Intrinsic motivations still reported the highest value, then came internalized extrinsic, followed by extrinsic. Respondents reported that intrinsic motivations encourage them to remain in OSSD projects to a high extent - the mean value was 4.53.

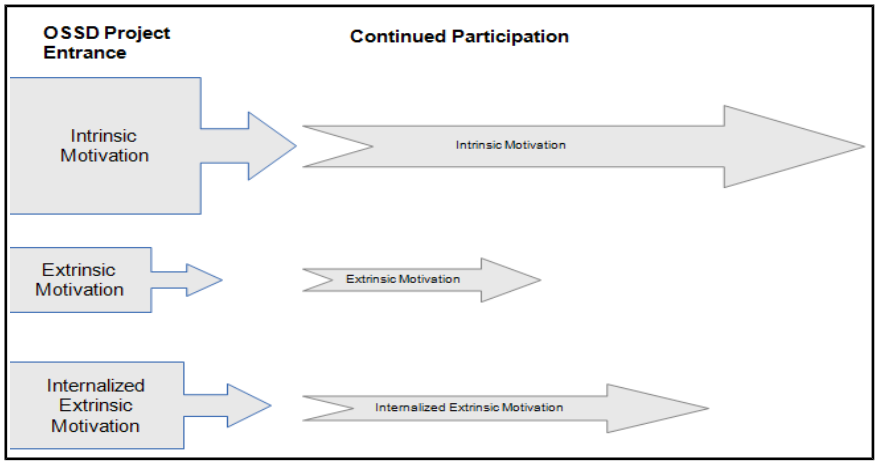


Figure 5.1 – Observed motivations for OSSD project entrance and continued participation

The value for the intrinsic category for continued participation is close to the one before project entrance. What was implied by this similarity is that the open source concept does not change software developers to make them become more intrinsically oriented, rather it seems to be the case that they decide to join OSSD projects because they seek to attain intrinsic needs that lie within themselves, and when they have joined the project they discover that these expectations were reasonable, thus they decide to remain in the project for the same reason. The important thing to consider in this context is that in order to outrun competitors in the pursuit for the most talented OSS developers, recruiters need to offer intrinsic motivations to attract developers at an initial stage, then the OSSD project has to continue to fulfill the intrinsic needs of these developers to reduce the risk of losing them to other competing projects.

Studies which have expressly focused on motivations for continued participation in OSSD projects (Latteman & Stieglitz, 2005; Wu et al, 2007) present the same variety of factors as other studies which have not taken the moment of entrance into concern, and likewise they also stressed the importance of intrinsic motivations. Since our study clearly differentiates between motivations before and after project entrance and furthermore compiles motivations under three categories, a more clear pattern has appeared, and intrinsic motivations for continued participation are emphasized more clearly.

The fact that developers are intrinsically motivated to remain in OSSD projects to such a high extent (mean value 4.53), means that they are expected to perform better than they would do in a conventional software development project (Ryan & Deci, 2000). This is an advantage for project participants since it provides a stimulating environment. OSS users can also find this beneficial, high performing and highly motivated developers will surely produce high quality software, which in this context also are free of charge. By adhering to the practices of OSSD it then seems as if the OSS beliefs - a part of the OSS ideology - which hold that OSSD methods produce code of higher quality than closed source (Stewart & Gosain, 2006) are amplified.

5.3 How do the motivations relate to each other?

Generally, previous studies have stated that both intrinsic and extrinsic motivations are important, and arguments about their relative value have varied (Benbya & Belbaly, 2010). OSS literature shows no consensus regarding which motivation that is most dominant (Roberts et al, 2006). Despite this diversity a majority have still focused on motivations that

pertain to the intrinsic category (von Krogh et al, 2012), thus it was not unexpected that the intrinsic category would present higher values than the other two categories, and motivates OSS developers to a high extent, both for OSSD project entrance as well as continued participation. It was however more of a surprise that the relationship between motivations was nearly identical before and after, since it could be expected that the project would change the motivations, as has been proposed by Shah (2006) and Roberts et al (2006).

The high values for the intrinsic category, both before and after project entrance, which have been observed in this study conforms with findings from Lakhani and Wolf (2005) who have found that intrinsic motivation, and expressing creativity in particular, is the strongest and most pervasive driver for OSSD. This thesis similarly came to the conclusion that OSS developers are mostly intrinsically motivated, hence it reinforces the belief that intrinsic motivations indeed are of a higher value. Moreover, results from this study provides a further perspective on this viewpoint by suggesting that intrinsic motivations are equally important in attracting developers to join OSSD projects and encouraging them to continue participating.

In the same way as the motivational categories demonstrate a similar pattern before and after project entrance, a majority of the motivational factors within the categories present values that are close to each other before and after. However, one specific instance can be found where they differ somewhat. In the intrinsic category kinship amity motivated respondents to remain in projects (mean value 4.14) more than it motivated them to join the project (mean value 3.77). What possibly happens is, that once developers have joined a project they become part of the community and feel as though they belong. Developers might then feel a need to continue to participate in the project to remain connected with peers and obtain such gifts that are inherent to the relationship, but not always explicitly pronounced (Zeitlin 2003).

With regards to these gifts offered within the context of kinship amity, the limited impact of gift economy/reciprocity as a motivational factor both before and after project entrance can also be explained. It can be argued that developers do not value the gift economy/reciprocity that OSSD projects offer because they already receive such gifts indirectly simply by belonging to the community, for instance in terms of feedback.

In the extrinsic category pay as an individual factor had lower values than career both before and after developers join OSSD projects. Prior to project entrance the mean value for pay was 2.24, and after the mean value was 2.46, compared to 3.64 before and 3.90 after for career. These values suggest that to attract software developers to OSSD projects monetary rewards

are not an important factor. In the search for skilled software developers recruiters working for communities and firms that run OSSD projects should not focus on offering them pay. Likewise, introducing or increasing monetary rewards should, according to these results, not be regarded as one of the main measures that needs to be taken in order to motivate developers to remain in the project.

The results for pay as a motivation stand partly in contrast to findings from Alexy and Leitner (2011) who have argued that pay motivates OSS developers as long as it was not strongly expected. Findings from our survey imply that pay was not strongly expected, because of the low value before project entrance. The same has been suggested in several studies (Lee & Kim, 2013; Benbya & Belbaly, 2010; Shah, 2006; Lerner and Tirole, 2002) which have stated that most software developers are volunteers and do not receive payment, thus commonly they do not expect monetary rewards. According to the reasoning by Alexy and Leitner (2011) the perception that pay was not strongly expected prior to OSSD project entrance should mean that pay becomes an important motivational factor, however, on the contrary, the results have shown that pay does not motivate software developers to continue to participate in OSSD project to a high extent. Still, on the other hand, the fact that the mean value for pay before project entrance was low does not have to imply that it was not strongly expected. It can instead simply mean that though developers expected to receive payment for their work, it still was not an important motivation for them. To be able to argue against the reasoning by Alexy and Leitner (2011) the survey would have needed to explicitly ask whether respondents expected to receive payment before joining their OSSD project.

Similar to the reasoning above, the results from the survey which show that pay does not motivate developers to continue to participate in OSSD projects to a high extent can be interpreted in two ways. Either, since it has been found that 40% of contributors to OSSD projects are paid (Lakhani & Wolf, 2005), it can be held that the reason why monetary rewards did not motivate developers in this study to remain in OSSD projects was that they were not paid for their efforts. Alternatively, on the other hand, the results can readily be regarded as an implication that monetary rewards are not very important for OSS developers and that they do not motivate them much to continue to participate in OSSD projects. As mentioned, data about whether developers expect to receive monetary rewards in OSSD projects would be required in order to determine this issue.

The one motivational factor that motivated OSS developers to join and remain in OSSD projects the most was learning. The mean value was 5.1 before project entrance and 5.02 after.

In accordance with these results, a majority of previous studies on OSSD motivations (von Krogh et al, 2012), have identified learning as a factor that motivates OSS developers. Ghosh (2005), who has surveyed the largest sample of respondents (2700) among all identified OSSD motivations studies, has held that the most important reason to join and continue in the community is to learn and develop new skills. The reason for this agreement might be that learning is a constant inherent process in OSSD projects, software development in general can be perceived as such a complex task that learning is a demand, which in turn leads to a benefit. Learning is an internalized extrinsic factor and as such is extrinsic at the outset (Deci & Ryan, 1987), but can be expected to fulfill some of the basic intrinsic needs, mainly competence and development (Deci & Ryan, 2008). The concept of intrinsic motivations describes a natural inherent desire toward mastery, spontaneous interest, and exploration (Ryan & Deci, 2000) which closely relates to learning. This suggests that learning is of a more intrinsic than extrinsic nature, and, as already discussed, it might be on a higher level of internalization.

The fact that the relationship between motivational categories was very alike before and after developers join OSSD projects, as it was clearly expressed through figure 4.3 and 4.4, provides input to the debate about whether the motivational categories can coexist (Hayenga & Corpus, 2010). As Roberts et al (2006) have pointed out, having explored the relationship between motivations in the context of a study as ours signals whether motivations are independent, complementary, or contradictory. Answering this question is significant because a viewpoint in some studies on OSSD has been that motivations are complementary (Roberts et al, 2006). However, if some motivations are negatively related to others, as can be interpreted by the results from this study, it means that increasing the level of those motivations may crowd out other motivations for participating (Roberts et al, 2006). From our research it seems that a high value on one category automatically results in a low value for the others, be it before when the motivations are presumed, or after when the motivations are available to the developer. Since the relationship between categories was almost identical before and after it can be further argued that the intrinsic category diminishes the extrinsic, and to some extent the internalized extrinsic.

Because the values for the intrinsic category were the highest ones both before and after project entrance it appears to be the case that the ascendancy of the intrinsic motivations prior to project entrance crowded out the extrinsic motivations and made them remain less significant in encouraging OSS developers to continue to participate in OSSD projects. Previous studies, such as Alexy and Leitner (2011), which have held that motivations crowd out each other have mostly focused on how extrinsic rewards makes the effects of intrinsic

motivations less significant. Results from our study indicate that in the reversed case, when intrinsic motivations are given more importance, the effect is the same, meaning that extrinsic motivations become diminished.

6. Conclusion

This study has approached the topic of OSSD motivations from dimensions that had previously been limitedly explored. The aim was to find out which types of motivations that attract software developers to OSSD projects (research question 1), and which types of motivations that encourage software developers to continue participating in OSSD projects (research question 2). Moreover, the issue was to find out how these types of motivations relate to each other in terms of whether some motivations encourage developers to join and continue to participate in OSSD projects to a higher extent than others, and if the motivations crowd out each other (research question 3).

In summary, results concerning the first first and second research question indicate that OSS developers are highly intrinsically motivated, less internalized extrinsically motivated, and even lesser extrinsically motivated to join as well as to continue participating in OSSD projects. Accordingly, having grouped together motivations into categories, pattern similarities could be clearly observed. The conclusion that could been drawn from the results was that OSS developers are intrinsic people by nature, it is not the projects that change them, rather developers are attracted to OSSD projects because these projects enable them to fulfill intrinsic needs to be found within themselves. At the next stage, as developers discover that OSSD project realize their intrinsic aims they remain intrinsically motivated throughout. The results further indicate that OSSD methods are more effective than conventional software methods and are expected to produce software of higher quality. This is due to the perception that intrinsically motivated developers can reach their highest potential and perform more well than extrinsically motivated developers.

From practitioners point of view this study implies that recruiters do not need to be very flexible concerning the rewards that are offered before and after developers' project entrance, instead they should foremost assure to be intrinsically appealing to attract developers, at a first stage, and also, similarly, focus on providing intrinsic motivations at a later stage in order to motivate them to continue participating in OSSD projects. The study further indicates that recruiters should look to attract intrinsically motivated developers from the beginning rather than expecting them to change their motivations, and become more intrinsically oriented, by

time. Results from this research can also be used to determine choices concerning how to specifically deal with the motivational factors throughout all phases of OSSD projects in order to both attract developers and encourage them to continue to participate. The survey results (Appendix C) in particular can serve as a means for deciding how to prioritize between motivational factors.

Concerning the third research question, there were clear similarities in the pattern that was found when comparing before and after project entrance. The results from comparisons before and after the involvement of a project reinforces each other since they were shown to be very similar. Results indicate that motivations crowd out each other, in the sense that a person who is highly intrinsically motivated accordingly has low extrinsic motivation, and vice verse. It is hence vital that the people who provide the incentives realize that if they decide to primarily offer extrinsic motivations the developers will be less extrinsically motivated, and as such demonstrate poorer performances.

Appendix A – Literature sample from von Krogh et al (2013)

	Ideology	Altruism	Kinship	Fun	Reputation	Reciprocity	Learning	Own-use	Career	Pay
Alexy and Leitner 2007										✓
Baldwin and Clark 2006										
Benkler 2002				✓						✓
Berquist and Ljungberg 2001						✓				
Bitzer et al. 2007		✓						✓		
David and Shapiro 2008	✓		✓			✓	✓	✓		
David et al. 2003	✓					✓	✓	✓		
Fershtman and Gandal 2004										
Ghosh 2005	✓	✓			✓		✓	✓	✓	✓
Hars and Ou 2002		✓	✓		✓		✓	✓	✓	
Haruvy et al. 2003		✓								
Hemetsberger 2004	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Hertel et al. 2003	✓		✓	✓	✓			✓	✓	✓
Ke and Zhang 2008		✓								
Lakhani and von Hippel 2003	✓			✓	✓	✓		✓		
Lakhani and Wolf 2005	✓		✓	✓	✓	✓	✓	✓	✓	✓
Lattemann and Stieglitz 2005					✓			✓		✓
Lee and Cole 2003										
Lerner and Tirole 2002					✓				✓	
Luthiger and Jungwirth 2007				✓						✓
Markus 2007										
Okoli and Oh 2007					✓					
O'Mahony and Ferraro 2007										
Oreg and Nov 2008		✓			✓		✓			
Osterloh and Rota 2007		✓						✓		
Riehle 2007									✓	
Roberts et al. 2006				✓	✓		✓	✓	✓	✓
Rullani 2007										
Schofield and Cooper 2006		✓	✓					✓		
Shah 2006	✓			✓		✓	✓	✓		
Spaeth et al. 2008					✓		✓			
Stewart et al. 2006										
Stewart and Gosain 2006	✓	✓			✓		✓			
von Hippel and von Krogh 2003				✓			✓	✓		
von Krogh et al. 2003										
Wu et al. 2007		✓					✓	✓	✓	
Xu et al. 2009	✓			✓	✓		✓	✓		

Appendix B – Additional literature

Author(s)	Year	Title
Baytiyeh & Pfaffman	2010	Open source software: A community of altruists
Benbya & Belbaly	2010	Understanding Developers' Motives in Open Source Projects: A Multi-Theoretical Framework
Fershtman & Gandal	2007	Open source software: Motivation and restrictive licensing
Krishnamurthy	2006	On the Intrinsic and Extrinsic Motivation of Free/Libre/Open Source (FLOSS) Developers
Sauer	2007	Why develop open-source software? The role of non-pecuniary benefits, monetary rewards, and open-source licence type

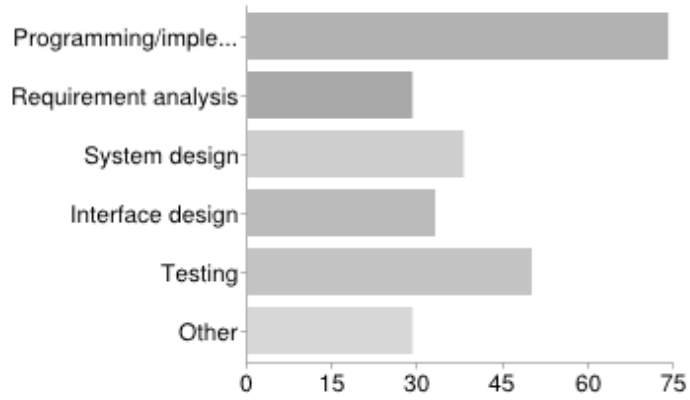
Appendix C – Survey results

Question number	Question	Factor	Category	Before project entrance	After project entrance	Mean	Median	Mode	Std deviation
4	To what extent did your personal ideology initially motivate you to join the project?	Ideology	Intrinsic	✓		4.64	5	5	1.47
5	To what extent did the oppurtunity to voluntarily do good for others without personal gains initially motivate you to join the project?	Altruism	Intrinsic	✓		4.35	5	6	1.56
6	To what extent did the thought of belonging to a community initially motivate you to join the project?	Kinship amity	Intrinsic	✓		3.77	4	4	1.71
7	To what extent did the opportunity to enjoy yourself and have fun initially motivate you to join the project?	Enjoyment and fun	Intrinsic	✓		4.76	5	6	1.42
8	To what extent did the possibility of earning a reputation initially motivate you to join the project?	Reputation	Internalized extrinsic	✓		3.78	4	6	1.78
9	To what extent did the opportunity to receive gifts initially motivate you to join the project?	Gift economy/reciprocity	Internalized extrinsic	✓		1.75	1	1	1.21
10	To what extent did the opportunity to learn initially motivate you to join the project?	Learning	Internalized extrinsic	✓		5.1	5	6	1.23
11	To what extent did the opportunity to use software for your own purposes initially motivate you to join the project?	Own-use value	Internalized extrinsic	✓		4.23	5	6	1.74

12	To what extent did future career opportunities initially motivate you to join the project?	Career	Extrinsic	✓		3.64	4	4	1.82
13	To what extent did monetary rewards initially motivate you to join the project?	Pay	Extrinsic	✓		2.24	1	1	1.80
14	To what extent does your ideology motivate you to remain in the project?	Ideology	Intrinsic		✓	4.61	5	5	1.34
15	To what extent does the will to do good for others without personal gains motivate you to remain in the project?	Altruism	Intrinsic		✓	4.54	5	6	1.50
16	To what extent does the feeling of belonging to a community motivate you to remain in the project?	Kinship amity	Intrinsic		✓	4.14	5	6	1.77
17	To what extent does enjoyment and fun motivate you to remain in the project?	Enjoyment and fun	Intrinsic		✓	4.82	5	6	1.43
18	To what extent does reputation motivate you to remain in the project?	Reputation	Internalized extrinsic		✓	3.89	4	6	1.66
19	To what extent do gifts motivate you to remain in the project?	Gift economy/reciprocity	Internalized extrinsic		✓	1.80	1	1	1.30
20	To what extent does learning motivate you to remain in the project?	Learning	Internalized extrinsic		✓	5.02	5	6	1.31
21	To what extent does the use of software for your own purposes motivate you to remain in the project?	Own-use value	Internalized extrinsic		✓	4.07	4	6	1.77
22	To what extent do career opportunities motivate you to remain in the project?	Career	Extrinsic		✓	3.90	4	6	1.74
23	To what extent do monetary rewards motivate you to remain in the project?	Pay	Extrinsic		✓	2.46	2	1	1.76

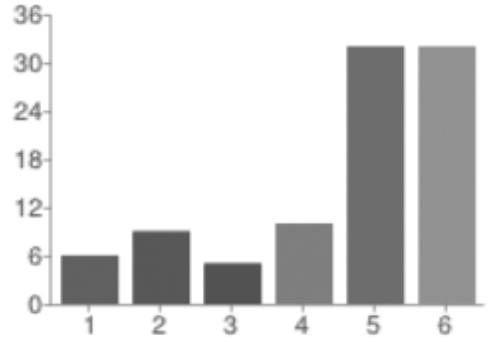
Appendix D – Illustration of survey results

Which of the following activities are included in your work tasks for this project?



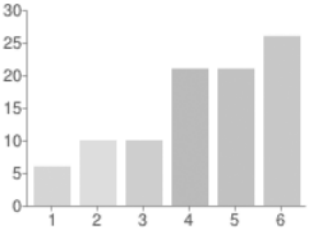
Programming/implementation	**74**	29%
Requirement analysis	**29**	11%
System design	**38**	15%
Interface design	**33**	13%
Testing	**50**	20%
Other	**29**	11%

To what extent did your personal ideology* initially motivate you to join the project?



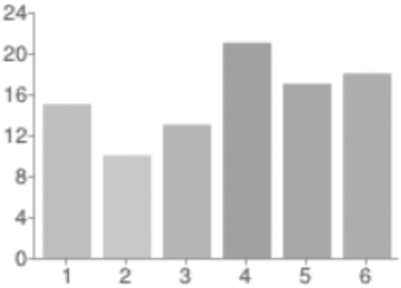
1	**6**	6%
2	**9**	10%
3	**5**	5%
4	**10**	11%
5	**32**	34%
6	**32**	34%

To what extent did the oppurtunity to voluntarily do good for others without personal gains initially motivate you to join the project?



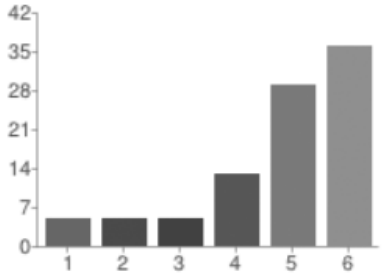
1	**6**	6%
2	**10**	11%
3	**10**	11%
4	**21**	22%
5	**21**	22%
6	**26**	28%

To what extent did the thought of belonging to a community initially motivate you to join the project?



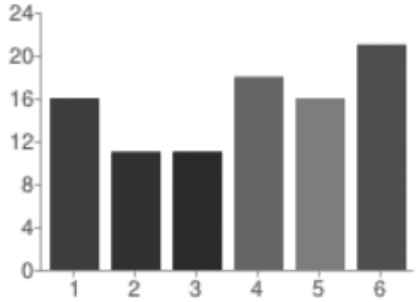
1	**15**	16%
2	**10**	11%
3	**13**	14%
4	**21**	22%
5	**17**	18%
6	**18**	19%

To what extent did the opportunity to enjoy yourself and have fun initially motivate you to join the project?



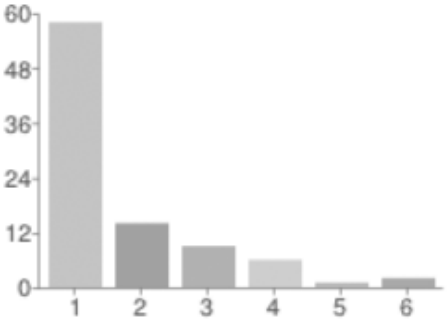
1	**5**	5%
2	**5**	5%
3	**5**	5%
4	**13**	14%
5	**29**	31%
6	**36**	39%

To what extent did the possibility of earning a reputation initially motivate you to join the project?



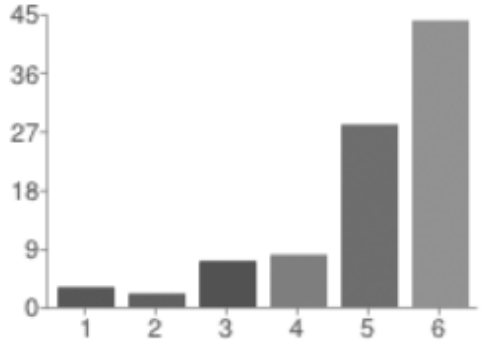
1	**16**	17%
2	**11**	12%
3	**11**	12%
4	**18**	19%
5	**16**	17%
6	**21**	23%

To what extent did the opportunity to receive gifts initially motivate you to join the project?



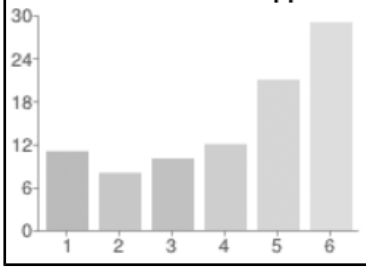
1	**58**	64%
2	**14**	16%
3	**9**	10%
4	**6**	7%
5	**1**	1%
6	**2**	2%

To what extent did the opportunity to learn* initially motivate you to join the project?



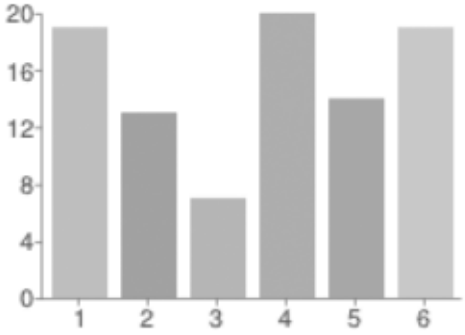
1	**3**	3%
2	**2**	2%
3	**7**	8%
4	**8**	9%
5	**28**	30%
6	**44**	48%

To what extent did the opportunity to use software for your own purposes initially motivate you to join the project?



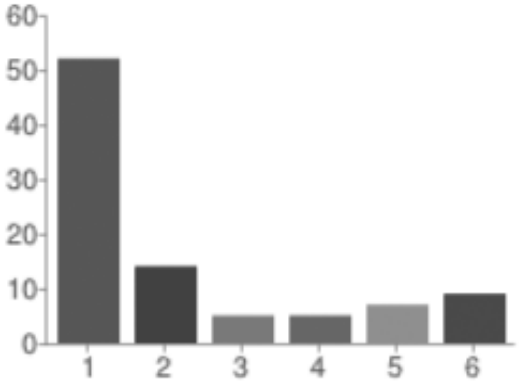
1	**11**	12%
2	**8**	9%
3	**10**	11%
4	**12**	13%
5	**21**	23%
6	**29**	32%

To what extent did future career opportunities initially motivate you to join the project?



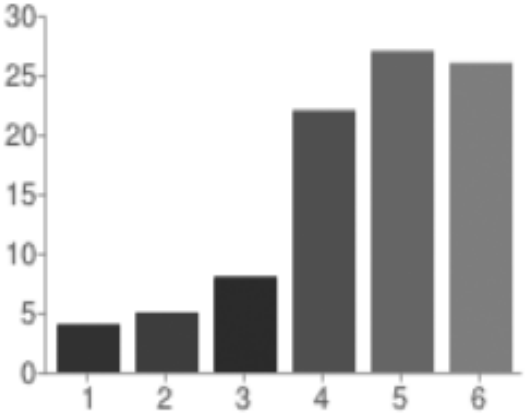
1	**19**	21%
2	**13**	14%
3	**7**	8%
4	**20**	22%
5	**14**	15%
6	**19**	21%

To what extent did monetary rewards initially motivate you to join the project?



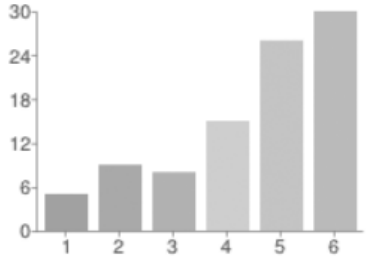
1	**52**	57%
2	**14**	15%
3	**5**	5%
4	**5**	5%
5	**7**	8%
6	**9**	10%

To what extent does your ideology* motivate you to remain in the project?



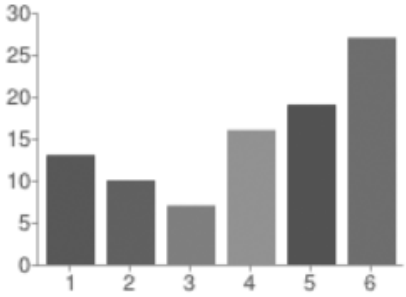
1	**4**	4%
2	**5**	5%
3	**8**	9%
4	**22**	24%
5	**27**	29%
6	**26**	28%

To what extent does the will to do good for others without personal gains motivate you to remain in the project?



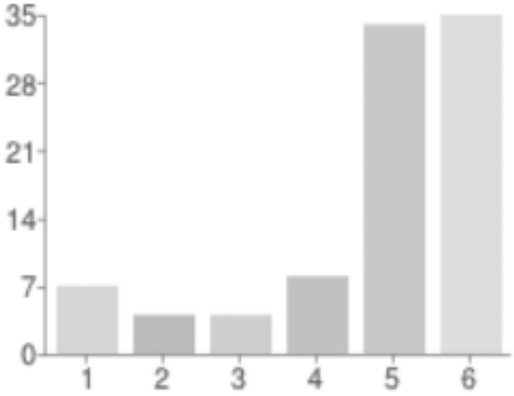
1	**5**	5%
2	**9**	10%
3	**8**	9%
4	**15**	16%
5	**26**	28%
6	**30**	32%

To what extent does the feeling of belonging to a community motivate you to remain in the project?



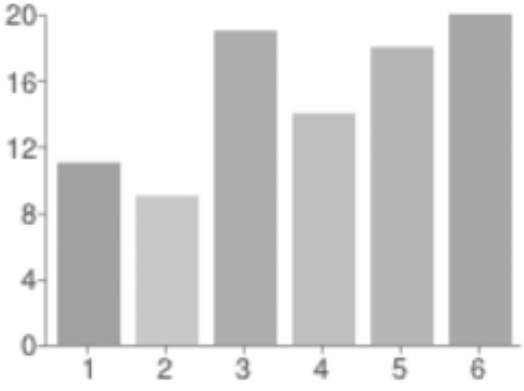
1	**13**	14%
2	**10**	11%
3	**7**	8%
4	**16**	17%
5	**19**	21%
6	**27**	29%

To what extent does enjoyment and fun motivate you to remain in the project?



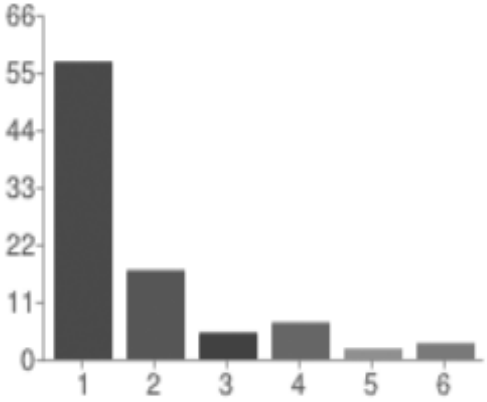
1	**7**	8%
2	**4**	4%
3	**4**	4%
4	**8**	9%
5	**34**	37%
6	**35**	38%

To what extent does reputation motivate you to remain in the project?



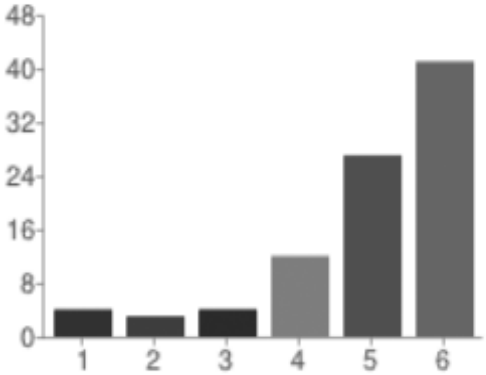
1	**11**	12%
2	**9**	10%
3	**19**	21%
4	**14**	15%
5	**18**	20%
6	**20**	22%

To what extent do gifts motivate you to remain in the project?



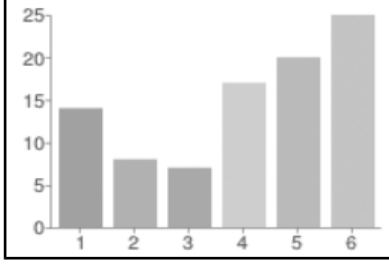
1	**57**	63%
2	**17**	19%
3	**5**	5%
4	**7**	8%
5	**2**	2%
6	**3**	3%

To what extent does learning* motivate you to remain in the project?



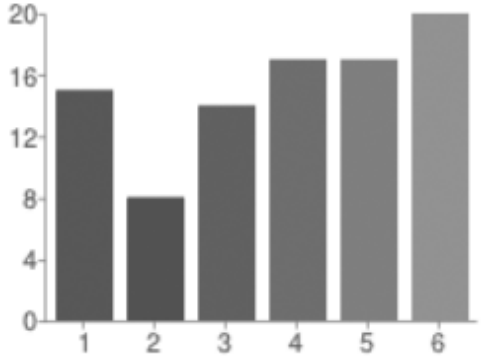
1	**4**	4%
2	**3**	3%
3	**4**	4%
4	**12**	13%
5	**27**	30%
6	**41**	45%

To what extent does the use of software for your own purposes motivate you to remain in the project?



1	**14**	15%
2	**8**	9%
3	**7**	8%
4	**17**	19%
5	**20**	22%
6	**25**	27%

To what extent do career opportunities motivate you to remain in the project?



1	**15**	16%
2	**8**	9%
3	**14**	15%
4	**17**	19%
5	**17**	19%
6	**20**	22%

When did you first join the project?

2009-08 2009-11 2009 2012-05 2009 2003 2009-03 2012-04 2012-08 2008-04 2010 2008 2011-01 2008 2012-06 2008-01 2011-05 2011-03 2000-01 2009-05 2011-06 2006-01 2000 2007 2011 2008-01 2007-07 2003-05 2006 2011-11 2012 1988-09 2011-12 2013-02 2009 2011-11 2009-10 2008 2002 2012-11 2010 2006 2007-03 2004-10 2012-4 2007-11 2010 2012-08 2011-12 2013-01 2007-05 Somewhere in 2010 2012-05 2008-01 2009-10 We started the project 2012-06 2011-02 2013-01 2011-11 2012-03 2007-10 2002-04 2012-02 August 2008 2007-05 2012-2 2012-10 2008-03 2011-03 2008-04 2004-07 2011-06 2011 2010-05 2009-09 2011-06 2009-07 1972 2012-04 2012-03 2008 1996-10 2008 2008 2001-10 2012-05 2010-07 2010 2006-11 2007-06 2009-09 2010 2008

*** Do you feel that there are some other factor(s) that initially motivated you to join the project?**

I created the project because I needed it, I then released it in case anyone else wanted it. I wrote a program (KCM Wacom Tablet/Nepomuk WebMiner) that wasn't available yet and I thought beside my own use other could benefit from it too (and they do) Chance to work with the best ones in the industry. This is not the same as "belonging to the community": The people already working on it The use I have for the final roduct It was a task that needed to be done. Nobody had picked it up, so I did. I was fed up with commercial software vendors over charging and under delivering. Passion and doing good in the intererest of users of teh software (clients) is a better motivator than quarterly sales targets without caring about the clients / users. I like to stick it to proprietary software companies that get fat & complacent. Last year a friend of mine hired me as the second employee of a brand new venture of his. He had already somehow convinced an actual real money-making company that they needed to redesign their crappy, clunky, piece-of-donkey-dung industrial robot. He had also somehow got them to pay him to do the redesigning, despite the fact he had never ever done anything remotely related. (Good salesman, lol) They bought 6 of them sight unseen. One thing the customer wanted was a small stream of data returned from their robot to the operator. I thought "No problem, Just send it on one of the wires in the umbilical." Silly me. They say "all the wires are in use, and everything has to be backwardly compatible. Also there are no computers connected to the robot .... also it has to be really small, waterproof, and tolerant to the occasional 240-volts transients that sometimes occur when the cable gets bent. ... also we need it cheap and fast ... also all of our documentation is in german... and our photocopier is broken, so we can't give you any copies anyways... we're also out of coffee." He knew nothing about electronics or even electricity. He needed help. I like to help, and I was also broke, so I started working for him for a small salary. I hijacked some space in his workshop and called it the electronics department. I had no idea what I was doing or where to begin. I was terrible at soldering, and my multimeter was on the fritz. I think I was the only person who was willing to take a stab at the problem for so little money. That's the unglamourous story of the start. I've been part of the initial development team at StarDivision that designed StarOffice starting 1995. StarOffice was opensourced after Sun Microsystems bought this company. I'm still proud of the work we had done at that time. At work we needed a simple reporting tool. Since there was no budget for it I started it as open source in my spare time and then introduced it at work, at first without saying that it was written by me :-) Teaching opportunities sure, but those are personal :) Self satisfaction above all other nonsense. Don't believe or trust any other person/corporate body to ensure your better well being Collaboration with an interesting individual, a larger than life software developer who happens to be blind. Verimail.js är ett tilläggsprogram som vi sedan lanserade på Comfirm för att få kunder att ledas in på vår AlphaMail eller liknande. Idag pular flera med vår Verimail.js: http://www.youtube.com/watch?v=-YRXmB2ZHzI http://www.youtube.com/watch?v=JlfzW5t_9QA Verimail används som du ser i videorna för att se om en mail är rättstavad genom att checka domänen och även om domänen innehåller en mailserver. nope Give sth back to the community gh Yes the Freedom Choices and Liberty. Give back to open source community what was given to me by others. The feature was missing and that was bothering a lot of people (me most of all), so there: I fixed it ;). The wish to create and help maintain something that other people would find useful My curiosity around the open source community I wanted to follow the development of the project. Used the software. Wanted to extend it. Found a wonderful framework that is pleasant to work with. Great devs in the community. Yes. I am retired, but I love programming and want to go on doing it as long as I can. And I want others to share the results. No I wanted to fix bugs that affected me. Economic necessity. They offered me a job when I needed one. The ideology of open source. It has a lot to do with the values of freedom and democracy and these are values I do want to fight for. As for this project in particular, I had no previous experience with this kind of technology/software and it is an area that not many have experience in (one of the hardest areas in software engineering), so the opportunity to learn it and be one of the few experts in this area was too tempting to pass on. I felt the bragging rights that I would earn and having an impact on a software used by so many was just everything for me. To learn more about the software and improve how it worked for me personally a better world Because, I like the way in which it goes. Scratching an itch

*** Do you feel that there are some other factor(s) that motivate you to remain in the project?**

The people friendships and collborative work in the comunity, plays a great part of me staying in the project.

I just love learning, and if I can give back to the community at the same time, even better. They main reasons are the fun factor, beeing part of a large community and the feel that the own work is useful for others too. Being part of continuous contribution to a job well done. Do not underestimate the satisfaction of just giving. Open Source and the supported Open Source model is the only sustainable model for software. All value created is available to all for free and thus government, (but also companies) should spend our money wisely and not pay for licences. In case you lake the knowledge and or resources you have the option to buy support. So basically the users have the freedom to decide and that makes. I like to provide competition to proprietary software vendors that have little incentive otherwise to innovate & maintain an edge in the marketplace. 1) There might be some poor bastard who is currently trying to solve the same stupid problem I have made a solution to. They might be able to avoid the anguish and occasional soul-sucking monotony I went though. Needless suffering eventually kills the *spark* of a good engineer. I don't want that to happen if I can help it. 2) We will all benefit if a future engineer can skip re-engineering the mousetrap by using my mousetrap. I want the future engineers to use their skills to build cool shit! This system is not "cool shit" IMO. 3) I want to make more money some day. I might someday apply for a job elsewhere. I have no formal engineering education, no pedigree, and no feet in any doors. I'm unlikely to get a job unless I provide verifiable evidence that I can build the things I claim I can build. Evidence that I'm not just another lazy fucker who just wants a paycheck. I hope they see what I've done and believe me. 4) I have borrowed so much knowledge from the world and given back so little. I would feel selfish if I kept it all to myself. Those are the reasons I remain. see above The greatest motivation is the feedback from around the world by people who use it. They simply say "thanks" or ask for additional features. It's very unlikely that I will ever meet one of them in real life, but it is fun and to some extend good for my ego. Ability to maintains the skills I have, but don't use in daily job. Teaching opportunities its the best portal product out there. No Pay, No free goods, helping others achieve what I never could. Ensuring that the next generation has it all now and not later on. (What that means is they they pay through the nose for it all) The user base still needs this software. almost everything I met many very interesting persons and we became friends ghf sorry, too long. Got bored. The community members that have now become friends My job for the company that build the project I'm working on - I got hired a couple of months after joining as an open source developer and now spend time writing proprietary pieces of software too Same. Continued use of the software. Basically that helping others get the software we used helped us and that there were likely other people that could benefit and contribute. No I use Linux daily and want to know what happens in its development. They are far more flexible with working conditions. Remote work in particular. The ideology of open source. It has a lot to do with the values of freedom and democracy and these are values I do want to fight for. Also, staying close to an open source project makes it easier for me to stay up to date with the political movements and issues related to freedom and technology. As for this project in particular, I feel that there are still a lot to learn and new challenges arise all the time, so I'm never bored. To continue to improve the software for my own uses a better world Because, I use it.

Appendix E – Web survey

Open Source Software Development Motivations

We are two Swedish students conducting research on open source for a masters' thesis. We are interested in finding out what initially motivated you to join the open source project that you are currently engaged in, and what motivates you to continue to contribute to this project. The survey only takes around 3-5 minutes to fill out. Your anonymity Thank you for your efforts.

Which open source project are you currently working with?

If you are contributing to several projects, please select the one you put most effort and time in

- ○ GNU/Linux
- ○ KDE
- ○ Apache (ASF)
- ○ Perl CPAN
- ○ Mozilla
- ○ Gnome
- ○ Eclipse
- ○ Other:

Which of the following activities are included in your work tasks for this project?

- ☐ Programming/implementation
- ☐ Requirement analysis
- ☐ System design
- ☐ Interface design
- ☐ Testing
- ☐ Other:

When did you first join the project?
Year-Month. Ex: 2010-12

To what extent did your personal ideology* initially motivate you to join the project?
*norms, beliefs and values

	1	2	3	4	5	6	
Nothing	○	○	○	○	○	○	Very much

To what extent did the oppurtunity to voluntarily do good for others without personal gains initially motivate you to join the project?

	1	2	3	4	5	6	
Nothing	○	○	○	○	○	○	Very much

To what extent did the thought of belonging to a community initially motivate you to join the project?

	1	2	3	4	5	6	
Nothing	○	○	○	○	○	○	Very much

To what extent did the opportunity to enjoy yourself and have fun initially motivate you to join the project?

	1	2	3	4	5	6	
Nothing	○	○	○	○	○	○	Very much

To what extent did the possibility of earning a reputation initially motivate you to join the project?

1 2 3 4 5 6

Nothing ○ ○ ○ ○ ○ ○ Very much

To what extent did the opportunity to receive gifts initially motivate you to join the project?

1 2 3 4 5 6

Nothing ○ ○ ○ ○ ○ ○ Very much

To what extent did the opportunity to learn* initially motivate you to join the project?
*knowledge, skills and experience

1 2 3 4 5 6

Nothing ○ ○ ○ ○ ○ ○ Very much

To what extent did the opportunity to use software for your own purposes initially motivate you to join the project?

1 2 3 4 5 6

Nothing ○ ○ ○ ○ ○ ○ Very much

To what extent did future career opportunities initially motivate you to join the project?

1 2 3 4 5 6

Nothing ○ ○ ○ ○ ○ ○ Very much

To what extent did monetary rewards initially motivate you to join the project?

	1	2	3	4	5	6	
Nothing	○	○	○	○	○	○	Very much

To what extent does your ideology* motivate you to remain in the project?
*norms, beliefs, values

	1	2	3	4	5	6	
Nothing	○	○	○	○	○	○	Very much

To what extent does the will to do good for others without personal gains motivate you to remain in the project?

	1	2	3	4	5	6	
Nothing	○	○	○	○	○	○	Very much

To what extent does the feeling of belonging to a community motivate you to remain in the project?

	1	2	3	4	5	6	
Nothing	○	○	○	○	○	○	Very much

To what extent does enjoyment and fun motivate you to remain in the project?

	1	2	3	4	5	6	
Nothing	○	○	○	○	○	○	Very much

To what extent does reputation motivate you to remain in the project?

1 2 3 4 5 6

Nothing ○ ○ ○ ○ ○ ○ Very much

To what extent do gifts motivate you to remain in the project?

1 2 3 4 5 6

Nothing ○ ○ ○ ○ ○ ○ Very much

To what extent does learning* motivate you to remain in the project?
*knowledge, skills and experience

1 2 3 4 5 6

Nothing ○ ○ ○ ○ ○ ○ Very much

To what extent does the use of software for your own purposes motivate you to remain in the project?

1 2 3 4 5 6

To what extent do monetary rewards motivate you to remain in the project?

1 2 3 4 5 6

Nothing ○ ○ ○ ○ ○ ○ Very much

*** Do you feel that there are some other factor(s) that initially motivated you to join the project?**

*Not required

*** Do you feel that there are some other factor(s) that motivate you to remain in the project?**

*Not required

Submit

Never submit passwords through Google Forms.

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