8-6-2011

So Many Developers, So Many Projects: Toward a Motivation-Based Theory of Project Selection

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ABSTRACT

Studies into open source software (OSS) development projects have hitherto focused on the question of why people are motivated to contribute to these projects, thereby assuming that motivational factors are the same across all types of OSS projects. In this study we challenge this assumption by investigating the question what motivates developers' selection of an OSS project depending on the level of license restrictiveness. Hereto we first develop a comprehensive multi-theoretical model of developers' motivations based on a literature review of foundational theories of motivations from multiple disciplinary backgrounds. Second, through data from 159 surveys, we show that developers' motivations indeed influence the selection of projects to which they contribute based on license restrictiveness. Drawing upon our findings, we propose a theoretical process model of project selection. This model helps to understand the relations between motivations, project selection and level of contribution and can be applied in future research.

Keywords

Open source software, motivation, license restrictiveness, project selection

INTRODUCTION

Existing literature on Open Source Software (OSS) communities has frequently addressed the question of why people participate in and contribute to these communities without distinguishing between different OSS projects. Hence, the literature up to date seems to assume the existence of a general set of motivational factors that are the same across different types of OSS projects. In this paper, we propose that OSS projects differ, hence, that developers might have different motivations for selecting the particular OSS project they contribute to.

One important variable for distinguishing between different types of OSS projects is license restrictiveness. License restrictiveness is a significant differentiator since (1) it is one of the most fundamental configurations in an open source project (Colazo and Fang, 2009) and (2) it influences the entire OSS development process. Previous studies have suggested that license restrictiveness influences the level of contribution of developers to the project (Fresthman and Gandal, 2007; Colazo and Fang, 2009; Lerner and Tirole, 2005a), however, did not regard the role of license restrictiveness as a differentiating variable of OSS projects.

In this study, we suggest that developers' motivations to participate in and contribute to a particular OSS project may potentially differ depending on the license restrictiveness of OSS projects. In other words, the motivations to participate in an OSS project with a highly-restrictive license are not necessarily the same as the motivations to participate in an OSS project with a non-restrictive license.

In order to answer the question of what motivates developers' selection of a particular OSS project distinguished by license restrictiveness, this paper presents and tests a comprehensive multi-theoretical model of possible underlying motivations. Whereas previous models have been formulated to understand the motivations of people contributing to open-source communities (Hertel *et al.*2003), these models have not provided a comprehensive integration of existing theories of motivations, but have rather relied on a small set of motivational theories. Therefore, based on an extensive literature review,

[1] All authors contributed equally to this article.

this paper extends these existing models by incorporating a set of foundational theories of motivations from multiple disciplinary backgrounds. By broadening the theoretical focus, this comprehensive model helps us to capture the idiosyncrasies and complexities associated with the selection of a particular OSS project based on license restrictiveness.

In order to test this multi-theoretical model, we analyzed data from 159 surveys of OSS developers from 88 different OSS projects. A better understanding of which individual motivations influence the selection of OSS projects distinguished by license restrictiveness might help to understand different individual preferences for different types of communities. This in turn could inform the design of OSS communities to attract particular individuals through different levels of restrictiveness.

In short, this paper provides three contributions. First of all, we offer a comprehensive, multi-theoretical model of motivation that builds upon, yet extends existing models of innovation. Second, rather than assuming one general set of motivations for participating in OSS projects, we distinguish different motivations for different types of OSS projects, distinguished by license restrictiveness. Finally, based on the findings from this study, we offer a process model of the relations between motivations to participate, project selection and level of contribution as the basis for future research on OSS projects. We propose this model as the basis for an emerging motivation-based theory of project selection that applies not just to OSS projects but rather generalizes to other communities and organizations for open innovation, collaboration and sharing.

In what follows, we first set the stage by describing OSS and OSS projects. Then we provide an extensive literature review of existing theoretical models of motivation, followed by a discussion of different OSS licenses. Based on the literature review of existing theories of motivation, we present our conceptual framework. Subsequently, following the discussion of the research design, we provide an overview of the results of our survey study. To conclude, we discuss our findings as well as a set of limitations and implications.

THEORETICAL FRAMEWORK

Open Source Software

Open source software (OSS) is software of which the source code is released and disclosed under licensing terms that allow modified versions to be redistributed (Colazo and Fang, 2009). Due to the disclosure, anyone is free to re-use or amend the source code resulting in loosely-knitted communities of programmers that manage and develop the software (Hertel et al, 2003). For the largest part, these project communities consist of programmers that do not receive a formal payment for their contributions (Hertel et al, 2003). However, there are viable business models using OSS and certain developers do receive a direct income for programming OSS (Hars and Ou, 2002; Krishnamurthy, 2003).

Over the last years, the number of OSS projects has grown and some projects became so successful that they compete with proprietary software programs (Colazo and Fang, 2009). Examples of well-known OSS are the Linux operating system, the Firefox web browser and the OpenOffice.org office production suite.

A small selection of (Open Source) software projects is depicted in the timeline in **Error! Reference source not found.** to illustrate the maturing of OSS. In the beginning of (Open Source) software projects, the sharing of source code was highly open and informal. Yet, in the 1980s, more restrictive licenses for code sharing became popular. However, more recently, we can witness a movement in the direction of less restrictive licenses.

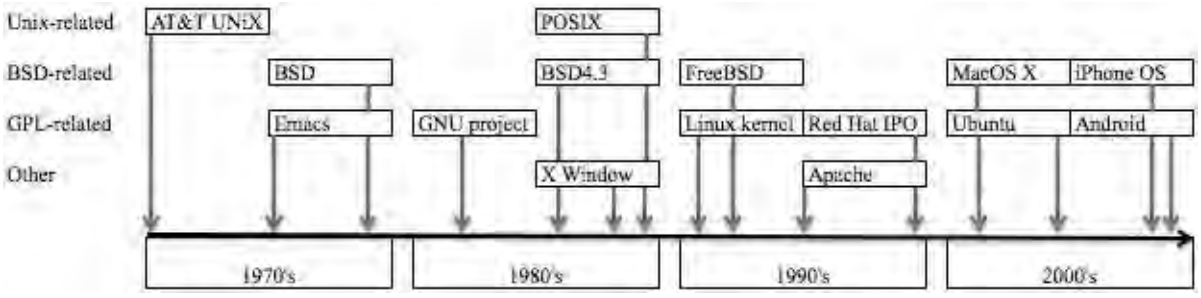

Figure 1. Timeline of Relevant (Open Source) Software Projects

Different License Types

In this study we classify OSS projects by differentiating between different levels of license restrictiveness. Hereto we draw on the license restrictiveness classification by Lerner and Tirole (2005b) and Kaminski and Perry (2007) as presented in Table 3 below. Non-restrictive licenses (such as BSD) allow the Open Source code to be used in any project (including proprietary). Restrictive licenses (such as LGPL) do not allow the usage of licensed code in non-restrictive or proprietary licensed software, but allow the usage of its libraries in such software. Highly restrictive licenses (such as GPL) do not allow the code to be used in any project with a different license.

Non-restrictive	Restrictive	Highly restrictive
Apache Software License	Apple Public Source License	CeCILL License
BSD license (original or revised)	Common Public License	GNU General Public License (GPL)
Intel Open Source license	GNU Lesser General Public License (LGPL)	XFree86 License
ISC License	IBM Public License	
Microsoft Public License (Ms-PL)	Microsoft Reciprocal License (Ms-RL)	
MIT or X11 License	Mozilla Public License (MPL)	
Perl Artistic	Nethack Public License	
PHP License	QT Public License	
Python License	Ruby License	
Zope Public License	Sun Public License	
Public domain		

Table 1. Licenses categorized by restrictiveness (Lerner and Tirole, 2005b; Kaminski and Perry, 2007)

Motivations of Open Source Developers

In this section, we summarize a set of foundational theories of motivations from multiple social science disciplines to provide the basis for a comprehensive and integrated multi-theoretical model of motivations of OSS developers. Specifically, we draw upon Transaction Cost Economics (Ngwenyama and Bryson, 1999), Principal Agent Theory (Eisenhardt, 1989), Maslow's Hierarchy of Needs (Maslow, 1954), Self-Determination Theory (Ryan and Deci, 2000), Herzberg Two-Factor Model (Miner, 2005), Goal Setting Theory (Locke and Latham, 1990), Expectancy Theory (Locke and Latham, 1990), Theory of Planned Behavior (Ajzen, 1991), the Theory of Swift Trust (Meyerson et al., 1996; Jarvenpaa et al. 1998), Volunteer Function Inventory (Clary et al., 1998), Extended Klandermans Model (Hertel et al., 2003), and the VIST model (Hertel et al., 2003).

Given the limited space, we summarize the underlying motivational constructs that we have deducted from existing models of motivation in Table 1 and 2 below. Table 1 summarizes constructs from models of motivation that have been previously used to understand motivations of OSS developers in particular. Table 2 displays constructs from existing theories of motivation in general, that is, which have not yet been applied for understanding the motivations of OSS developers. As the tables show, theories of motivation frequently refer to the same underlying constructs while using different terminology. Therefore, in these tables we delineate a set of foundational constructs of motivation that integrate the plethora of existing motivational construct terms from the literature through defining a set of consistent and distinct concepts.

	Model																							
	Extended Klandermans				VIST				Maslow					Herzberg		Volunteer Function Inventory								
Extended Model of Hars and Ou	Collective motives	Norm-oriented	Reward	Collective identity	Valance	Instrumentality	*Self-efficacy*	Trust	Self-actualization	Esteem	Love/belonging	Safety	*Physiological*	Motivator	Hygiene	Values	Understanding	Social	Career	Protective	Enhancement			
Internal (intrinsic)																								
Intrinsic: Fun and enjoyment, control in community			x			x			x					x						x	x		
Altruism			x						x					x		x							
Community: Community identity, Reciprocity			X	x							x			x				x					
Community: Trust								x				x			X								
Collective motives: Goals of project, ideology	x				x									x				x					
External (extrinsic)																								
Direct income			X									x		x										
Human capital: Enhancing, Self-marketing			X						x					x			x		x					
Peer recognition: Peer recognition, Reputation		X								x				x				x						
Personal needs			X		x									x										

Table 2. Theoretical model: the constructs and their relation to the relevant models and theories

		Bitzer et al., 2007	Bonaccorsi and Rossi, 2006	Bonaccorsi and Rossi, 2003	Ghosh et al., 2002	Hars and Ou, 2002	Haruvy et al., 2003	Hertel et al., 2003
Internal (intrinsic)								
Internal	Fun and Enjoyment	Homo ludens	Fun to program	Pleasure of creativity		Intrinsic		Reward: fun
	Control in community							Instrumentality: contributions are crucial
Altruism		Gift culture: Altruism	Altruism		Share knowledge and skills	Altruism	Altruism	
Community	Reciprocity							
	Community Identity	Gift culture: Kin	Sense of belonging in a community		Participate in scene	Community identity		Collective identity: user, open source, project
	Trust							Trust
Collective motives	Goals of project							Collective motives: goals of project and open source. Valence: success is important
	Ideology		Fight against proprietary software		Against property rights/monopolistic power			
External (extrinsic)								
Direct income			Monetary reward, low opportunity cost			Revenues from related products and services		Reward: lack of payment
Human Capital	Enhancing Human Capital		Gaining future career benefits, learning, working with bleeding edge technology		Improve job opportunities and learn new skills	Improve job opportunities based on expanded skill base		Reward: career advantages, improving skills
	Self-marketing			Signaling of quality		Self-marketing (signaling)		
Recognition	Peer recognition		Gaining reputation among peers	Intrinsic motivation		Peer recognition		Norm-oriented (only within projects)
	Reputation	Gift culture: Reputation		Prestige				Reward: reputation
Personal needs		Need for software	Contribution and feedback from the community, scratching a personal itch	Intrinsic	Improve current code, solve a problem, getting help	Personal needs, Peer recognition		Reward: better software, personal exchange

Table 3. Constructs and corresponding constructs as labeled in literature

		Lakhani and Wolf, 2003	Lerner and Tirole, 2002	Li et al., 2006	Osterloh et al., 2003	Shah, 2005	Wu et al., 2007	Ye and Kashida, 2003
Internal (intrinsic)								
Internal	Fun and Enjoyment	Enjoyment based	Fun	Enjoyment-based	Intrinsic: fun	Fun and challenging		
	Control in community					Control		
Altruism							Helping behavior: give a hand	
Community	Reciprocity	Obligation		Obligation-based	Intrinsic: obligation by norms	Reciprocity	Helping behavior: give a hand back	
	Community Identity					Fit		
	Trust				Trust			
Collective motives	Goals of project							
	Ideology			Obligation-based				
External (extrinsic)								
Direct income		Extrinsic: immediate payoff						
Human Capital	Enhancing Human Capital	Human capital: improving skills		Identified regulations		Project specific knowledge	Enhancing human capital: learning	Learning
	Self-marketing	Career advancements	Signaling: career concern and access to VC		Peer recognition: signaling		Signaling: Career concern and access to VC	
Recognition	Peer recognition		Signaling: ego gratification incentive	Introjected regulations	Peer recognition			
	Reputation						Helping behavior, giving: social status	
Personal needs		Extrinsic: immediate payoff and problem solving. Peer review	Improved software		Improve amendments	Need driven, Future improvements: feedback	Satisfying personal needs	

Table 3 Continued. Constructs and corresponding constructs as labeled in literature

Conceptual Framework

Drawing on the insights from the theoretical discussion in this section, we further conceptualize the relationship between developers' motivations and the selection of a particular OSS project distinguished by license restrictiveness in the model below (Figure 2). Using the existing literature as summarized in Table 1 and 2, we were able to hypothesize the nature of the relationship between only 6 out of the 14 motivational constructs and license restrictiveness (see Figure 3). From the theory we could not deduct the nature of the relationships between the remaining 8 motivational constructs and license restrictiveness, hence, the analysis of these relationships will be exploratory.

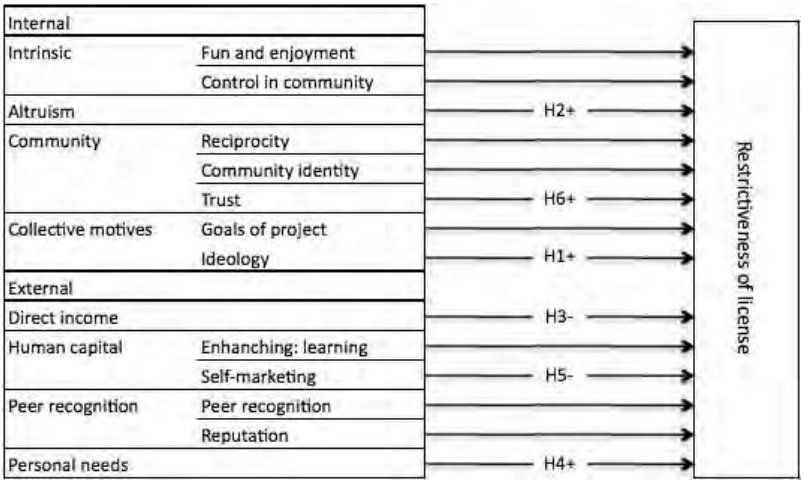

Figure 2. Conceptual model with hypothesized influences on license restrictiveness

RESEARCH DESIGN

The target respondents of this study are developers in OSS projects. Within OSS projects, communication occurs primarily through mailing lists, therefore, we decided to distribute the survey invitation through these lists. The 88 mailing lists that we used for distributing the survey invitation were selected from popular (Open Source) software websites (e.g. Freshmeat and Download.com) and source code repositories (e.g. SourceForge and BerliOS). If the lists allowed non-members to send emails (37 mailing lists), the survey invitation was send directly. However, where this was not the case (51 mailing lists), a request was sent to the mailing list moderator to forward the survey invitation. From these 88 mailing lists, 47% used highly restrictive licenses, 27% restrictive licenses and 25% non-restrictive licenses.

In order to operationalize the 14 motivational constructs—i.e. the independent variables—we adapted existing scales, as summarized in Table 4[2]. In addition to these independent variables (Table 4), the survey included six control variables frequently used in behavior studies, which we adapted from existing literature, namely *Project member competence* (Kohli and Jaworksi, 1994), *Creativity* (Ganesan and Wietz, 1996), *Innovativeness* (Leavitt and Walton, 1988), *Project commitment* (Mowday, Steers and Potter, 1979), *Self-efficacy* (Hertel et al, 2003), and *Autonomy in job* (House, 1971). Furthermore, a series of descriptive variables regarding the demographics of survey respondents was included (see results section).

Finally, the dependent variable, *license restrictiveness*, was measured using the classification of licenses from Lerner and Tirole (2005b), presented earlier in this paper (Table). The construct is measured as a three point ordinal scale where non-restrictive licenses are valued as 1, restrictive licenses as 2, and highly restrictive licenses as 3. The final study was preceded by a pilot study to test the feasibility of the instrument.

[2]See Appendix for a more extensive overview of survey scales and items

Parent-construct	Construct/Scale	Adapted from: (source and scale)
Intrinsic	Fun and enjoyment	Hars and Ou (2002): Intrinsic motivation
	Instrumentality	Hertel et al (2003)
Altruism	Altruism	Hars and Ou (2002): Altruism; Misje et al (2005): Value
Community	Reciprocity	Li et al (2006): Obligation based motivation; Cox and Soldo (2004): Reciprocity; Bonaccorsi and Rossi (2006): Social motivation
	Community identity	Hars and Ou (2002): Altruism; Hertel et al (2003): Collective Identity
	Trust	Hertel et al (2003); Trust
Collective motives	Project goal evaluation	Hertel et al (2003): Valance; Hertel et al (2003): Collective Motives; and one item self-developed
	Ideology	Li et al (2006): Obligation based motivation; Bonaccorsi and Rossi (2006): Social motivation; Bonaccorsi and Rossi (2006): Economic motivation
Direct income	Direct income	Hars and Ou (2002): Extrinsic motivation; Hars and Ou (2002): Future returns
Human capital	Enhancing Human Capital	Hars and Ou (2002): Future return; Li et al (2006): External identified regulation; Lakhani and Wolf (2003)
	Self-marketing	Hars and Ou (2002): Future returns; Li et al (2006): External identified regulation; Li et al (2006): External introjected regulation
Recognition	Peer recognition	Hars and Ou (2002): Altruism; Pelletier et al (1995): External regulated; Li et al (2006): Introjected regulation
	Reputation	Lakhani and Wolf (2003); Hertel et al (2003): Reward; Bonaccorsi and Rossi (2006): Economic motivation
Personal needs	Personal needs	Hars and Ou (2002): Personal needs; Hertel et al (2003): Reward; Bonaccorsi and Rossi (2006): Economic motivation

Table 4. Survey scales and sources of independent variables

RESULTS

In what follows, we first present the descriptive statistics and findings from the exploratory factor analysis followed by the results from the regression analysis.

The electronic distribution of the survey through relevant mailing lists resulted in 159 respondents. The total number of the mailing lists subscribers is unknown so the response rate cannot be calculated. The majority of developers (n=75) are between 20 and 34 years old, 98% (n=156) are male, and 79% (n=126) hold an associate or higher degree. One in five earns more than US$110,000, and just over half of the respondents have a higher than median income. Of the respondents, 53% is paid for programming, working either as salaried or contracted programmer. More than half of the respondents (n=87) originate from the EU and one in five from the US. Developers mostly use GNU/Linux or a BSD-variant as the operating system for their main computer (89%), followed by Apple's MacOS X, which uses a BSD-variant as the base layer.

The respondents release their code to projects licensed under different levels of restrictiveness. Sixty percent do that under highly restrictive licenses, with 58% working with GNU General Public License (GPL) and 2% with other highly restrictive licenses. Thirty percent contribute to projects licensed as non-restrictive of which the BSD license is the largest group (21%). A small group (10%) works under a restrictive license, where 8% works under GNU Lesser General Public License (LGPL).

A factor analysis was performed to check the validity of the constructs of our model. The reliability of the scales is presented in Table 5 below. Due to limited reliability certain constructs (*) are treated with care or are excluded (**) from the analysis.

Constructs	**Cronbach's α**		**Constructs**	**Cronbach's α**
Fun and enjoyment	0.740		Peer recognition	0.670
Instrumentality	0.855		Reputation	0.853
Altruism	0.798		Personal needs	0.519*
Reciprocity	0.641		***Controls***	
Community identity	0.804		Project member competence	0.815
Trust	0.584*		Self-efficacy	0.753
Project goal evaluation	0.791		Decision making	0.643
Ideology	0.830		Creativity	0.616
Direct income	0.891		Job scope	0.562
Enhancing Human Capital	0.686		Innovativeness	0.478**
Self-marketing	0.823		Project commitment	0.430**

Table 5. Scale Reliability

Tests for normality and multicollinearity ensured that the assumptions underlying the regression analysis were met. The model, which was analyzed through a linear regression analysis, proved significant ($F_{14,158} = 2.57$, $p < 0.05$). The results revealed five factors as significant predictors of the selection of projects based on license restrictiveness (marked by * in table 6), accounting for 25% of the variance ($R^2 = .25$; $R^2_{adj} = 15\%$). Adding control variables to the model did not significantly increase the explained variance, hence, were excluded for reasons of parsimony. Furthermore, we investigated the influence of income by performing a t-test between unpaid and paid developers, which showed no significant differences in group means.

Predictors	*β*	*SE*	*Std.β*	*t*	*Sign. level*
Constant)	1.906	.963		1.978	.050
Fun and enjoyment	.008	.151	.005	.051	.959
Instrumentality	.215	.084	.234	2.567	.012*
Altruism	.230	.112	.216	2.058	.042*
Reciprocity	.023	.099	.020	.230	.819
Community identity	.215	.174	.140	1.237	.219
Trust	.165	.102	.145	1.622	.108
Project goal evaluation	-.327	.130	-.231	-2.512	.013*
Ideology	.061	.116	.056	.532	.596
Direct income	.066	.078	.082	.847	.399
Enhancing Human Capital	-.318	.215	-.195	-1.478	.142
Self-marketing	.352	.152	.336	2.313	.023*
Peer recognition	.090	.119	.083	.755	.452
Reputation	-.425	.145	-.379	-2.937	.004*
Personal needs	-.103	.143	-.068	-.720	.473

Table 6 - Regression coefficients with the license restrictiveness scale as dependent variable

Of the significant predictors, three have a positive effect on license restrictiveness, namely instrumentality, altruism and self-marketing, and two have a negative effect, namely project goal evaluation and reputation. The motivation to participate thus affects the selection of a particular to an OSS project based on its license restrictiveness. In what follows, we will briefly discuss these five significant predictors.

Altruism: The influence of altruism as a motivational factor of developers was hypothesized to be positive on the selection of OSS projects based on their license restrictiveness. The developer motivated by altruistic needs to contribute to the project to help others by sharing code, helping others with problems and teaching others to code. It was hypothesized that the developer would want to protect these efforts by choosing projects with restrictive licenses. The results of the survey create more confidence in that this relationship is indeed positive: developers holding altruism as a motivational factor prefer projects with more restrictive licenses.

Instrumentality: We find a reasonable positive influence of **instrumentality** on the selection of OSS projects with more restrictive licenses. This construct represents the perceived importance and influence of the individual in the project. The discussed theories seem to give no suggestion to explain this influence. However, this finding is similar to the results for altruism. Thereby we can argue that if individuals perceive their contribution to be very significant they prefer to protect these efforts by choosing projects with restrictive licenses.

Project Goal Evaluation: We explored the direction of the relationship due to the lack of theory underlying this relationship. We find that the perceived value of project goals has a significant negative affect on the selection of open source projects differentiated by license restrictiveness. This implies that developers who value project goals prefer projects with less restrictive licenses. Even though we cannot rely on existing theory for explaining this relationship, it may be because developers are more committed to the goals of projects released under less restrictive licenses. This relationship should therefore be investigated further in future research.

Self-marketing: We find a significant positive effect on the selection of projects based on license restrictiveness. This means that developers holding self-marketing as a motivational factor prefer projects with restrictive licenses. This result contradicts the findings of Lerner and Tirole (2005b) that time and effort devoted by developers serving as a tool for self-marketing is greater under non-restrictive licenses. Therefore it supports the previous findings related to altruism and instrumentality; if plan to devote time and effort they prefer to protect these efforts by choosing projects with restrictive licenses.

Reputation: We find that reputation has a significant negative effect on the license restrictiveness, meaning that developers who aspire a higher reputation choose for OSS projects with less restrictive licenses. Based on the previous finding on self-marketing we would expect that developers motivated by reputation would also prefer projects with more restrictive licenses. Nevertheless projects with non-restrictive licenses (such as BSD) mention explicitly who coded what on an individual basis, while under highly restrictive licenses (such as GPL) contributors are mentioned as a group in a general overview of contributors (Colazo and Fang, 2009; Freshtman and Gandal, 2007). Thus projects with less restrictive licenses help to enhance reputation.

DISCUSSION AND CONCLUSION

The results of a regression analysis for answering our research question—what motivational factors influence the selection of an OSS project with a particular level license restrictiveness—showed that instrumentality, altruism, self-marketing, project goal evaluation and reputation significantly affect the selection of OSS project based on license restrictiveness.

Based on a critical reflection on the results it could be argued that analyzing the motivations to select OSS projects based on license restrictiveness might actually conceal the importance of popularity[3] instead of license restrictiveness for selecting projects. For example, most popular projects, such as the Linux kernel, OpenOffice.org and MySQL, are all developed under the highly restrictive GPL license. Hence it could be assumed that developers motivated by altruism, instrumentality and self-marketing projects with highly restrictive licenses because of their popularity. This should be investigated in future research. Additionally, we should explore other analytical procedures for testing the model and alternative sampling strategies for more detailed between groups analyses. Finally, through exploring other variables than license restrictiveness (e.g. size, success and age) that differentiate OSS projects we can obtain a more detailed understanding of developers' motivations for selecting projects.

[3] Popularity could be measured by project activity, number of involved developers and number of project-related web sites (see http://www.blackducksoftware.com/news/releases/2011-01-07)

Drawing on the insights of the study we propose a motivation-based process model for understanding the relationships between motivations, selection of projects and level of contribution (see Figure 3). With respect to the main relationships in this process model, this study focused on the relationship between motivations and project selection (arrow 1), which to the best of our knowledge has not been analyzed before. Previous studies on OSS projects have already shed light onto arrow 2. Future research should further explore the relationship between motivations and project selection (arrow 1) as well as analyze how contributions fuel future motivations to participate (arrow 3). With respect to the main constructs in this model, we offered a comprehensive theoretical model of motivations. However, more research is needed to explore project selection criteria beyond license restrictiveness as well as different forms of contributions. Within the context of OSS projects we can distinguish developers who initiate projects, those who manage projects and those who write code. It can be anticipated that different contributions stimulate different types of future motivations.

This model implies that future research should pay attention to the fit between individual motivations and project characteristics. In particular in the context of online communities where participation is voluntary, individuals have a choice to which project they want to contribute and this choice will be based on individual motivations and preferences. For example, an individual motivated by the desire for fun and enjoyment will sign up to Facebook, whereas an individual motivated by the desire for self-marketing or reputation enhancement will join LinkedIn.

Despite the limitations to generalizing beyond the context of analysis, we believe the same principles of fit between motivation and project selection may also apply to the relationships between stakeholders and organizations. Primary stakeholders, such as customers and suppliers, will increasingly select organizations based on the fit between personal preferences and organizational characteristics (e.g. sustainable practices, transparency and innovativeness). Hence, we argue that this process model represents an emerging theory of project (or organization) selection with practical repercussions for how people select projects and organizations based on their individual motivations.

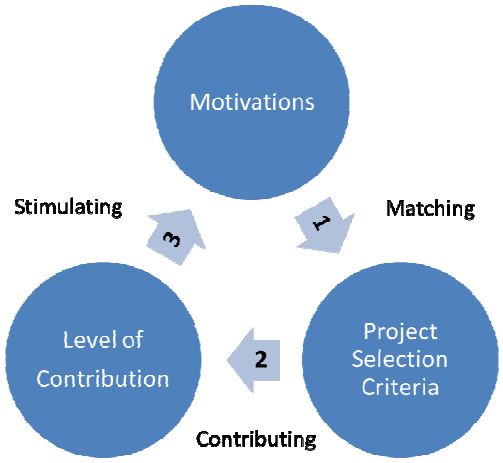

Figure 3. A Motivation-Based Process Model for Project Selection

To conclude, this paper provides three main contributions. First, by delineating a set of foundational constructs of motivation, we provide a comprehensive multi-theoretical model of motivation that integrates the plethora of existing motivational constructs from the literature. Second, the results of the survey show that developers' motivations determine which OSS project they contribute to depending on the license restrictiveness of that project. Whereas previous studies have analyzed motivations to contribute to OSS projects in general, this study reveals that it cannot be assumed that the motivations to contribute to OSS projects are the same for all projects. Third and most importantly, the process model presented above can be applied for understanding the relationships between motivations, selection of project and level of contribution. This process model offers an emerging theory of selection of projects and organizations that is not just useful in the context of OSS projects, but could potentially be applied in future research on organizations and communities of all sorts.

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APPENDIX: SURVEY SCALES, ITEMS AND SOURCES

Parent-construct	Construct/Scale	Measurement questions	Adapted from: (source and scale)
Intrinsic	Fun and enjoyment	1. Writing programs is fun. 2. I enjoy writing programs. 3. Programming gives me a chance to do the jobs I feel I do the best 4. Participating in the project gives me a feeling of accomplishment 5. Participating in the project gives me a feeling of competence	Hars and Ou (2002); Intrinsic motivation
	Control in community	1. I believe my personal contribution is crucial for the success of the project 2. It would make no difference for the success of the project if I would stop working for it 3. My skills as a software developer are very important for the progress of the project 4. My skills as a project member are very important for the progress of the project	Hertel et al (2003); Instrumentality
Altruism	Altruism	1. I don't care about money when contributing to the project 2. I deeply enjoy helping others, even if I have to make sacrifices	Hars and Ou (2002); Altruism
		3. I contribute to the Open Source project because it is important to help other people 4. I contribute to the Open Source project because I feel empathy towards the users of Open Source software	Misje et al (2005); Value
Community	Reciprocity	1. I feel a personal obligation to contribute to the project because I use Open Source software	Li et al (2006); Obligation based motivation
		2. Within the project, I do for others what they did for me 3. Within the project, I only help others whom I want to have help me in the future 4. Within the project, I only help others who have helped me in the past	Cox and Soldo (2004); Reciprocity
		5. I want to place my source code and skills at the disposal of the Open Source project and hope others will do the same	Bonaccorsi and Rossi (2006); Social motivation
	Community identity	1. Open source programmers should help each other out. 2. Open source programmers are a big family. 3. I am proud to be part of the Open Source Community.	Hars and Ou (2002); Altruism
		4. I identify with the Open Source software user community 5. I feel belonging to other Open Source software users 6. I identify with the community of the project 7. I feel belonging to other group members of the project	Hertel et al (2003); Collective Identity
	Trust	1. I expect that the other project group members put high efforts in the development of the project 2. I dislike it when some group members don't put much effort into the project	Hertel et al (2003); Trust

		3. I don't care much whether every member of our project group does her/his share of the work 4. I am satisfied with the fairness in recognition of efforts I put into the project	
Collective motives	Goals of project	1. The success of the project is very important to me	Hertel et al (2003); Valance
		2. I don't care much whether the project is successful or not	
		3. Working towards the goals of the project is very important to me	Hertel et al (2003); Collective Motives
		4. I am fully aware of the goals of the project	Self-developed
	Ideology	1. I contribute to Open Source software because I feel that source code should be open	Li et al (2006); Obligation based motivation
		2. I contributed to Open Source software because I identify with Open Source community values 3. I contribute to Open Source software because I feel that software should be free	
		4. I contribute to Open Source software because I think that software should not to be a proprietary good	Bonaccorsi and Rossi (2006); Social motivation
		5. I contribute to Open Source software to limit the power of large software companies	Bonaccorsi and Rossi (2006); Economic motivation
Direct income	Direct income	1. I am paid to work for the project	Hars and Ou (2002); Extrinsic motivation
		2. I receive some form of explicit compensation (eg salary, contract) for participating in the project	
		3. I will sell products related to the project	Hars and Ou (2002); Future returns
		4. I will sell consulting, training, implementation or customization services related to the project 5. In one-way or another I will make money from my participation in the project	
Human capital	Enhancing Human Capital	1. Experience from the project raises my skill level of programming 2. Experience from the project raises the level of my skills other than programming	Hars and Ou (2002); Future return
		3. Contributing to this project will improve my career choice regarding the field of IT that I wish to pursue 4. Contributing to this project will improve my competence as a programmer	Li et al (2006); External identified regulation
		5. Contributing to this Open Source project will enhance my professional status	Lakhani and Wolf (2003)
	Self-marketing	1. Participating in the project makes me more marketable. 2. Because of my involvement in the project, I will be able to get a better job.	Hars and Ou (2002); Future returns
		3. Eventually, contributing to the project will help me achieve my goal of increasing my marketability as potential employee for firms	Li et al (2006); External identified regulation
		4. I contribute to the project because I want to prove to potential employers that I am a knowledgeable IT person	Li et al (2006); External introjected regulation

Recognition	Peer recognition	1. Recognition from others within the project is my greatest reward	Hars and Ou (2002); Altruism
		2. I contribute to the project for the prestige of being an Open Source developer 3. I contribute to the project to show others how good I am as a programmer	Pelletier et al (1995); External regulated
		4. I feel important when I receive recognition from the community	Li et al (2006); Introjected regulation
	Reputation	1. I contribute to this project to enhance my reputation in the Open Source community	Lakhani and Wolf (2003)
		2. I contribute to the project because it is important to me to gain reputation as an experienced programmer inside of the Open Source community	Hertel et al (2003); Reward
		3. Opening my source code allows me to gain a reputation among Open Source software users 4. My contributions will enhance my reputation within the Open Source project	Bonaccorsi and Rossi (2006); Economic motivation
Personal needs	Personal needs	1. I use the software for myself very often (excluding programming or testing activities)	Hars and Ou (2002); Personal needs
		2. The software is critical for my business or my work	
		3. My participation in the open source project ensures that the software provides functionality that matches my unique and specific needs	
		4. Being able to fix problems with the software myself is one of the great advantages of open source software	
		5. I contribute to Open Source software because facilitation of my daily work due to better software is important to me	Hertel et al (2003); Reward
		6. I contribute to have products that are not available on the proprietary software market	Bonaccorsi and Rossi (2006); Economic motivation