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Motivations and Incentives of Participation in Open-Source Software ("OSS"):

A Review on Extrinsic and Intrinsic Motivations and how Motivation Matters in a Digital Domain

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ABSTRACT

The model of open-source software innovation is important because it guides the understanding and the process in which explicit knowledge becomes a public good through open innovation. Open-source software (OSS) has been viewed as challenging to classic economic theories and other developed models. According to the open-source model, two basic characteristics found in the private-collective are 'non-rivalry' and 'non-exclusivity' in consumption, meaning that innovation produced is viewed as a 'free good' that can be used without any restrictions and will not devalue through distribution (Von Krogh et al., 2006). The purpose of the review is to explore the available literature review on how and why developers participate in the open-source software movement, and how their contributions are viewed from different schools of thought on a broader digital domain.

Introduction

Knowledge is broadly defined as the understanding of concepts, facts, information or subjects. It does not appear all at once and accumulates slowly over time (Gächter et al. 2010). Over the past few years, firms have recognized the need for collaborative knowledge and tried to find ways to exploit internal innovation as well as motivate outside sources to innovate (Gächter et al. 2010; Dalle and Jullien, 2003). Some of the literature reviewed implicitly suggests that open innovation creates opportunities for firms to fuel innovation and enhance their creativity (Gächter et al. 2010; Lerner and Tirole, 2005, Krishnamurthy, Ou and Tripathy, 2014), hence making the term of open innovation a powerful framework used at the firm level to generate, capture and employ intellectual property. Other studies argue more on the side that open innovation creates an altruistic atmosphere where contribution happens on the values of collective goods and relationships (Bergquist and Ljungberg, 2001; Zeitlyn, 2003, Von Krogh et al., 2012). In our study of the patterns and practices related to motivations to participate in open-source software, we have observed the presence of different schools of thought and theories. Some of the technical-rational theories found in the literature focus on traditional approaches to extrinsic motivations driven by self-interest, career and pay incentives (Lakhani and Wolf, 2005; Bonaccorsi and Rossi, 2003; Lerner and Tirole, 2005), while socially-embedded theories offering anthropological and psychological points of view argue on the idea that "gift-economies" and reciprocity are primary incentives driving participation behind the OSS (Bergquist and Ljungberg, 2001, 305-320; Zeitlyn, 2003). Although the debate between different schools of thought does not fail to recognize the link between both intrinsic and extrinsic incentives, it also suggests a distinction between the when deciding to share knowledge rather than conceal it at the private-collective innovation model. The remainder of the paper follows this structure: First, it starts by exploring the most frequently used classifications of motivations behind the OSS. Second, it identifies different disciplines and their approaches to developers' motivations to participate in OSS, namely extrinsic and intrinsic motivations. Third, it explores existing literature in an attempt to make a broader sense of the contribution and why the contributions to OSS matter in a digital domain. The paper acknowledges the broadness of the private-collective innovation model and hence focuses mainly on OSS.

Method

To review the classifications of developers' motivations to participate in OSS, we have selected a total of 15 articles from 10 different journals. The academic journals were mostly published in Information Systems, Research Policy and Information Management, the most popular being MIS Quarterly and Information Systems Journal. To identify relevant articles, we conducted a search

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using selected search terms that represented the fields of A) Open-Source Software and B) Developers' motivations in participating in OSS. Articles were included if the theory they were based upon was identified; and if the main topic of the article was related to open-source software. Articles that failed to meet these criteria were excluded.

Classifications of Extrinsic and Intrinsic Motivations

The current literature on OSS developer motivation has identified several theories behind motivations that drive OSS but has mainly classified them as intrinsic and extrinsic motivations in the self-development theory. Although the literature reviewed is mostly based on the self-development theory, it is important to mention that this is not the only theory on which the motivations were based, and the spectrum of study is larger than what our review covers. Broadly, literature has categorized external goods as goods that include "capital, status, or power, which are the property of individuals and/or institutions" (Von Krogh et al., 2012) or as "expected future returns, personal needs" (Hars & Ou, 2002). Internal goods are defined as "public goods that benefit all participants in the social practice and the wider community" (Von Krogh et al., 2012) or as internal factors founded in altruism (Hars & Ou, 2002). Motivational components, as defined by literature, originate either from the act of participation (intrinsic) or from external rewards (extrinsic) (Von Krogh et al, 2012). Similar distinctions are also made by Choi, Kim, and Yu (2009), Bonaccorsi and Rossi (2003) and Krishnamurthy, Ou and Tripathi (2014). Several authors define some of the main internal motivators being altruism (Hars & Ou, 2002; Von Krogh et al., 2012, Baytiyeh and Pfaffman, 2010) and peer recognition or similarly defined as community identification (Hars & Ou, 2002; Bergquist and Ljungberg, 2001; Zeitlyn, 2003). The other body of literature notices the presence of self-interest (Lerner and Tirole, 2005; Lakhani and Wolf, 2005), human capital (Hars & Ou, 2002; Raymond, 1998), career and pay (Krishnamurthy, Ou and Tripathy, 2014). Although literature distinguishes between these two sources of motivations, it does not disregard the presence of the combination of intrinsic and extrinsic motivations in developers' motivation in participating in the OSS.

Understanding how Extrinsic and Intrinsic Motivations Work

The central idea and characterization behind the OSS were based on the idea of gift economies (Raymond, 1998; Zeitlyn; Von Krogh et al., 2006; Bergquist and Ljungberg, 2001). Gift economies are based on social relationships, values and norms created on the economy of gift exchange and are not "regulated by possession or exchange of money or commodities" (Bergquist and Ljungberg, 2001). The phenomena of gift-giving have been found as a common theme in (Bergquist & Ljunberg, 2001; Zeitlyn, 2003) where the authors dig into the classic writings on OSS and theoretical foundations that lead to the success of OSS. Their papers provide a theoretical overview from an anthropological point of view. For instance, (Zeitlyn, 2003) argues that the symbolic meaning of gift-giving revolves around reputation, power, and influence. Giving a gift, hence contributing, is translated into an obligation to the receiver that he/she has to give the 'gift' or code back. A similar argument is found in (Bergquist & Ljunberg, 2001) where the gift being exchanged is transformed from a product to an obligation, an argument which indicates the difference between gift and commodity transactions present in Dalle and Jullien (2003), Lerner and Tirole (2005) and Zeitlyn (2003). The empirical evidence found in Lerner and Tirole (2005), however, challenges the arguments mentioned above by stating that profit encourages investment, and as long as the benefits of participating exceed the costs of doing so, participation will occur. Hence, developers stop contributing to OSS development freely if their commercial payoff is not satisfactory (Lerner and Tirole, 2005). Nevertheless, throughout the literature, most of the authors viewed economic theories as not being able to fully explain the OSS phenomenon.

To anthropologists, concepts such as kinship, trust, and reciprocity are the main drivers behind the participation (Zeitlyn, 2003; Bergquist and Ljungberg, 2001). In an attempt to discern the social dynamics of OSS, Zeitlyn (2003) argues that the concept of kinship is built through interaction between developers where monetary transactions between kinship structures are nonexistent. For instance, Von Krogh et al. (2012) draw importance on social theory developed by Alasdair MacIntyre in 1981 (as cited in Von Krogh et al. 2012) of considering scientific knowledge as an internal good of science that "benefits the scientific community and humanity at large" (Von Krogh et al, 2006). In light of this theory, the authors in Von Korgh et al. (2012) develop a theoretical framework that views motivations from two different theories, self-determination, and the social practice view. As defined in the study, self-determination theory recognizes the presence of both intrinsic and extrinsic motives as "predictors and outcomes of institutional arrangements such as governance or norms" (Von Krogh et al, 2012, p.655). This theory assumes that the individual OSS developer views the output of his/her participation as a product in which he/she might get a reward of value (Von Krogh et al, 2012, pt. 655). On the other hand, the authors introduce an ethical dimension by using the social practice view which accounts for motivational dynamics and views outputs as goods that are moved by social practice to contribute to the collective good. The concept of open-source software development in relation to the idea of a collective good being shared to the community has been proposed in several other studies, where the main argument is that the "good" (the code) being produced follows standards defined by social practice, or the collective environment (Von Krogh et al, 2012; Baytiyeh and Pfaffman, 2010). A similar pattern was found in Baytiyeh and Pfaffman (2010) and Hars and Ou (2002) where the authors show empirical evidence how altruism and "the desire to help for the greater good worldwide" (Baytiyeh and Pfaffman, 2010, p.1345) was a primary motivation behind OSS contributors. The concept of 'collective good', viewed from anthropological perspectives, serves as an extension of the classical

notions of economics and therefore integrates more cultural and social terms to the term (Zeitlyn, 2003). For instance, Zeitlyn (2003) suggests that the notion of capital is extended to a symbolic capital to relate to the reputation gained through participating in the OSS. However, economic literature disregards the notion of symbolic capital somehow and views it as an increase in human capital that enables the participants to get better job opportunities, higher salaries and fulfilling jobs (Hars and Ou, 2002). This increase in human capital shows the benefits of career advancement, improvement of programming skills of the developer (Hars and Ou, 2002); hence, it connects more to the extrinsic values behind participation.

The main pattern found in the majority of literature mentioned above shows that developers are mostly motivated to contribute to this knowledge-building environment characterized by intrinsic motivations such as altruism, sharing knowledge for the good of the community, desire to learn, satisfaction, kinship, fun, reputation and reciprocity (Von Krogh et al, 2012; Zeitlyn, 2003; Baytiyeh & Pfaffman, 2010; Krishnamurthy et al. 2014; Von Krogh & Hippel, 2012) Strong supporting evidence of intrinsic motivations was also found in Lakhani and Wolf (2005) who study motivational components using regression analysis. Essentially, these patterns bring us to an interesting resemblance coined by Bergquist & Ljungberg (2001) between gift economies and academic research, which become key themes in understanding the quality assurance and share of knowledge in the OSS also implicitly found in Gächter et al. (2006). When an individual gives away knowledge, whether, in terms of code or information, they receive status and reputation and become visible to the academic community (Bergquist & Ljungberg, 2001). Their visibility is connected to an 'intellectual gratification' similar to scientific discovery in academia (Bergquist & Ljungberg, 2001). A slightly similar argument was found in Hars & Ou (2002) where the former found significant results in the level of identification within the hacker community that resembled a similar community as the academia mentioned in more socially-embedded studies (Bergquist & Ljungberg, 2005; Zeitlyn, 2003). In terms of reputation, economic-based literature has identified patterns of 'gaining status' that mainly guide how developers decide to contribute to enhancing their reputation in the open-source software community since reputation directly links to external benefits gained from contribution (Andersen-Gott, Ghinea, and Bygstad, 2012).

The Challenge to Conceptualize the Common Good in the OSS

The majority of literature observes the above-mentioned motivations of developers and/or firms behind the participation from different perspectives but struggles to determine how the model of open-source software alters other models affected by the public share of knowledge. As defined in one of the first attempts to define open source software, the notion of open-source software is developed because innovation and voluntarily effort of developers develop code and programs for the common good where "people bring their resources to the table" (Raymond, 1998, p.28). The core debate between already mentioned anthropological, economic and psychological based perspectives, but also by other disciplines such as information science, organization science, business ethics, and management, has emphasized the struggle to conceptualize open software as being 'free' and 'open-source,' and how the combination of the idea of public knowledge and free software affects communities, researchers, policymakers and the global internet community in general. Does open source software fall into libertarian values of altruism found in most of the body of literature, or is it another alternative of seeking profits by big corporations? An economic-based analysis of 'Libre' software argues that calling a software such as Linux 'free' or 'open-source' is misleading due to three reasons: "the software is being sold by companies, openness does not guarantee modification and not everyone is allowed to redistribute the software freely" (Dalle and Jullien, 2003, p.2). The main argument is that 'Libre' software could have the potential to be turned into an economic model and economic institution to improve collective welfare if the appropriate public intervention works as an enhancer mechanism for knowledge management (Dalle & Jullien, 2003). The authors' ability to conclude their arguments is very limited due to the ambiguity of the OSS viewed from an economic standpoint. But even so, another body of literature has stressed the concern that public intervention or patenting of knowledge will hinder growth (Lerner & Tirole, 2005). The economics of open access is stressed in Lerner & Tirole (2005) through the challenge of academic economic and "the rise of open access journals" (p.117), where the issues of sharing technology, setting common standards and combining "freely available and commercial components arise both in the open-source and commercial realm" (Lerner & Tirole, 2005). Bonaccorsi and Rossi (2003) also shed light into the peculiarity of the OSS and coordination issues of developers in the absence of a central authority, but argue that open source projects are far from being "anarchical communities" because licenses and tacit rules govern the structure of OSS (Bonaccorsi and Rossi, 2003, p.1246-1248).

Conversely, studies from anthropological viewpoints argue somewhat differently to knowledge-intensive goods. For instance, as also elaborated in the section of understanding extrinsic and intrinsic motivations, Zeitlyn (2003) argues that the discourse should take social theory into account. The idea of 'kinship structures' illustrates the social dynamics behind the OSS and how these structures are based on 'gift economies' where the exchange facilitates coordination without the need of a central authority (Zeitlyn, 2003). The analogy of 'kinship structures' reflects the software projects and participants within the OSS, claiming that these structures shape and confine the social webs that make up the open-source development. Bergquist & Ljungberg (2001) add to this line of argument by arguing that the open source communities are driven by norms of peer review as a social mechanism, reputation, and gift-giving. The 'digital gifts' involved in this process suggest

interdependencies between gift-givers and receivers but also restructures social relationships based on the type of digital information being exchanged. As the authors in Zeitlyn (2003); Von Krogh et al. (2012) and Bergquist and Ljubgber (2001) suggest, the 'gifts' being exchanged do not have the characteristics of products like defined in Lerner and Tirole (2005), but they hold the characteristics of obligations created through this give-and-receive relationship (Zeitlyn, 2003; Bergquist and Ljugber, 2001). Although these social relationships suggest an altruistic community based on libertarian values (Bergquist and Ljubgber, 2001), they do not necessarily exclude power given to the gifts exchanged. The same pattern was found in Zeitlyn (2003) within the notion of 'symbolic capital' where developers work to create power and influence under the concept of successful gift-giving (Zeitlyn, 2003, p.1289) Where this discussion usually ends, however, is on the question of the word 'open' in open source and how this reflects a decentralized knowledge sharing and innovating process. Whereas some are convinced that the OSS will continue to function on the idea of kinship, altruism and give-and receive relationship (Bergquist and Ljubgber, 2001; Zeitlyn, 2003), others maintain that such a process of open innovations needs effective public intervention that would serve as economic incentives in order to keep the incentives of contributing to the OSS going (Bonaccorsi and Rossi, 2003; Dalle and Jullien, 2003).

Conclusion

In this review, I have tried to examine literature based on the motivations behind participating in the open-source software movement, namely extrinsic and intrinsic motivations found in the self-development theory (Von Krogh et al., 2012). I note that several studies have formed theoretical frameworks with propositions to examine the types of motivations, and some have developed extensive research reviews to do so. I have also noted the presence of two main schools of thought, namely the social anthropological school of thought examined in Zeitlyn (2003), Von Krogh et al. (2012), Bergquist & Ljungberg (2001), Baytiyeh and Pfaffman (2010) and the more economic and market-based school of thought analysed in works such as Lerner & Tirole (2005), Bonaccorsi & Rossi, (2003) and Lakhani & Wolf (2003).

The reviewed literature also highlighted arguments from economic standpoints that view OSS as a complex issue in explaining how "open knowledge" thrives in an environment dominated by proprietary standards. In different circumstances, anthropological studies view the model through social theory and introduce concepts such as kinship structures, power relationships and altruism in an attempt to explain the motivations driving the OSS development (Bergquist & Ljungberg, 2001; Von Krogh et al 2006; Lerner and Tirole, 2005), while others argue in favour of appropriate public intervention as an enhancer mechanism for continuous open innovation (Dalle and Jullien, 2003; Lerner and Tirole, 2005). I hope this review offers greater insights and incentives to study whether the contributions in the open-source software are temporary by-products of a capitalist socio-economic regime or something that can have the potential of being an alternative to these models, and of course the ways in which this contribution, whether intrinsically and/or extrinsically initiated, matters in the digital domain.

References

Andersen-Gott, M., Ghinea, G. and Bygstad, B. (2012). Why do commercial companies contribute to open source software?. International Journal of Information Management, 32(2), pp.106-117.

Baytiyeh, H. and Pfaffman, J. (2010). Open source software: A community of altruists. Computers in Human Behavior, 26(6), pp.1345-1354.

Bergquist, M. and Ljungberg, J. (2001). The power of gifts: organizing social relationships in open source communities. Information Systems Journal, 11(4), pp.305-320.

Choi, C., Kim, S. and Yu, S. (2009). Global Ethics of Collective Internet Governance: Intrinsic Motivation and Open Source Software. Journal of Business Ethics, 90(4), pp.523-531.

Dalle, J. and Jullien, N. (2003). 'Libre' software: turning fads into institutions?. Research Policy, 32(1), pp.1-11.

Gächter, Simon, Georg von Krogh, and Stefan Haefliger. "Initiating Private-Collective Innovation: The Fragility Of Knowledge Sharing." Research Policy 39.7 (2010): 893-906. Web.

Hars, A. and Ou, S. (2002). Working for Free? Motivations for Participating in Open-Source Projects. International Journal of Electronic Commerce, 6(3), pp.25-39.

Hippel, E. and Krogh, G. (2003). Open Source Software and the "Private-Collective" Innovation Model: Issues for Organization Science. Organization Science, 14(2), pp.209-223.

Krishnamurthy, S., Ou, S. and Tripathi, A. (2014). Acceptance of monetary rewards in open source software development. Research Policy, 43(4), pp.632-644.

Lakhani, K. and Wolf, R. (2003). Why Hackers Do What They Do: Understanding Motivation and Effort in Free/Open Source Software Projects. SSRN Electronic Journal.

Lerner, J. and Tirole, J. (2005). The Economics of Technology Sharing: Open Source and Beyond. Journal of Economic Perspectives, 19(2), pp.99-120.

Raymond, E. (1998). The cathedral and the bazaar. First Monday, 3(2).

Von Krogh, G. and Von Hippel, E. (2006). The Promise of Research on Open Source Software. Management Science, 52(7), pp.975-983.

Von Krogh, Haefliger, Spaeth and Wallin (2012). Carrots and Rainbows: Motivation and Social Practice in Open Source Software Development. MIS Quarterly, 36(2), p.649.

Zeitlyn, D. (2003). Gift economies in the development of open source software: anthropological reflections. Research Policy, 32(7), pp.1287-1291.