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How do firms influence open source software communities? A framework and empirical analysis of different governance modes



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ABSTRACT

This paper explores how software firms can apply different types of governance approaches to open source software development projects (OSSDPs) and draws on control theory to propose that firms may influence OSSDPs by employing either leadership or resource deployment control. A matrix differentiating four types of OSSDPs: firm- versus community-initiated projects and one participating firm (single-vendor projects) versus many firms (multivendor projects), and accompanying hypotheses regarding a firm's participation for each type are developed. Using data from 83 Eclipse projects to test the hypotheses, findings indicate that (1) firms more actively employ both leadership and resource deployment in firm-initiated projects than in community-initiated ones and (2) firms are more likely to use resource deployment control over leadership control in multivendor projects. Key theoretical and managerial implications are discussed.

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1. Introduction

Decreasing license fees in the software market have given momentum to the open source software (OSS) development approach as a viable alternative to proprietary software development approaches (Augustin, 2008; Lerner & Schankerman, 2010; Teigland, Di Gangi, Flaten, Giovacchini, & Pastorino, 2014). Recent estimates exemplify OSS success and expect the OSS software market to be worth \$46 billion in 2015 (Statista, 2015). Revenue models associated with OSS range from dual licensing, which involves offering a product under an OSS license and (at least) one proprietary license, to revenue streams generated entirely through

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the sale of complementary products or services (Bonaccorsi, Giannangeli, & Rossi, 2006; Fitzgerald, 2006; Olson, 2005). The OSS source code is written in a human readable programming language and open to anyone, so capable users, whether individuals or firms, can modify the code according to their own needs (Von Hippel & Von Krogh, 2003). If a modification contributes to the quality of the original software (e.g., fixing a bug, adding new functionality), users often grant that extension freely to the project, which provides them greater reputational gains (Roberts, Hann, & Slaughter, 2006; Xu, Jones, & Shao, 2009). Thus, an OSS project often involves a relatively heterogeneous community of developers, bug fixers, users, and firms, if the project raises commercial interest (Dahlander & Magnusson, 2008). As communication within this heterogeneous group is characterized by computer-mediated interactions, OSS constitutes a relationship between information technology and organization that is different from relationships known to exist in traditional organizational forms (Simon, 1973).

From the firm's point of view, structures as those in OSS allow for integrating external resources (Grand, von Krogh, Leonard, & Swap, 2004). If a software firm can encourage voluntary external work, its development costs decrease, because in these situations the firm does not have to pay for the external contributions. Many firms increasingly initiate their own OSS projects rather than building on existing ones (Bonaccorsi & Rossi, 2006; Dahlander, 2007; Dahlander & Magnusson, 2008; Riehle, 2012). Thus, there is robust support for the existence of different types of open source software development projects (OSSDPs), but a dearth of research examines the differences in control mechanisms that govern such projects. We propose a conceptual framework based on (1) the distinction between projects that feature one dominant firm (single-vendor projects; SVP) and those with more than one participating firm (multivendor projects; MVP), and (2) whether they were initiated by a firm or the community of developers, and use this framework to analyze firm influence in OSSDPs.

As firms increasingly deploy resources to OSSDPs (Ghapanchi, 2013; Ghapanchi, Wohlin, & Aurum, 2014), they need to gain a better understanding of available governance modes that might enable them to exert some influence or even control. The proposed framework guides us in analyzing how firms make use of different options available to influence development communities. Conventional governance mechanisms, such as behavior or output control (Ouchi, 1979), are inapplicable to systems based on volunteer work where no contractual relationship exists (Lattemann & Stieglitz, 2005). However, developers who earn salaries from their employer are simultaneously embedded in organizational settings (Dahlander & O'Mahony, 2011; Dahlander & Wallin, 2006; Henkel, 2009). By inserting their norms and beliefs, which partly reflect the employing firm's influence, into the OSSDP, these employees allow firms to (indirectly) influence the project's trajectory—depending on the number of programmers assigned and their role in the project. Building on organizational control theory and governance literature, which distinguishes formal from informal control mechanisms (Aghion & Tirole, 1997; Kirsch, 1997; Ouchi, 1979; Rustagi, King, & Kirsch, 2008), we pursue a better understanding of different governance mechanisms in different types of OSSDP.

Based on the proposed framework and different options of influence, we analyze firm activity in projects that are hosted on Eclipse, a firm-dominated repository for business-related OSSDPs. We find support for our framework and identify different governance modes that in turn stem from different business interests.

The remainder of the paper is organized as follows. First, we review and synthesize literature on OSSDPs and organizational control. We then develop the rationale for the use of alternative conceptualizations of control followed by the development of our hypotheses. Next, we describe our research methods and results. We conclude by discussing theoretical and managerial implications.

2. Theoretical background and hypothesis development

2.1. A framework for classifying open source software projects

Literature on innovation in online communities and OSS is diverse (Aksulu & Wade, 2010). One stream of literature centers on online collaboration in various contexts such as music (e.g., Dahlander & Frederiksen, 2012; Jarvenpaa & Lang, 2011), cars (e.g., Füller, Matzler, & Hoppe, 2008), and software (e.g., O'Mahony & Ferraro, 2007). Although this research was heavily influenced by early research on free and open source software projects, OSS usually functions as an example of innovation with or by users, but is not at the core of the research interest. Another stream of research is more concerned with OSS as such and investigates internal organization of OSSDPs (e.g., Dahlander & O'Mahony, 2011; Rullani & Haeflinger, 2013; Stewart & Gosain,

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