The Effects of Communication Patterns on the Success of Open Source Software Projects: An Empirical Analysis from Social Network Perspectives

Jing Wu, School of Economic Information Engineering, Southwestern University of Finance and Economics, Chengdu, China
Khim-Yong Goh, School of Computing, National University of Singapore, Singapore, Singapore
He Li, Fogelman College of Business and Economics, The University of Memphis, Memphis, TN, USA
Chuan Luo, School of Economic Information Engineering, Southwestern University of Finance and Economics, Chengdu, China
Haichao Zheng, School of Economic Information Engineering, Southwestern University of Finance and Economics, Chengdu, China

ABSTRACT

Drawing on the theoretical lens of communication patterns in organizational theory, this research analyzed the longitudinal success of open source software (OSS) projects by employing social network analysis method, based on extensive analyses of empirical data. This study is expected to provide an understanding on how communication patterns established in different roles and different levels. The authors not only measured OSS success from both developers and users’ perspectives, but also extended the existing research by including the potential relationships among these success measures in the estimation model. Following the panel data econometric analysis methodology, they evaluated their research hypotheses using the Three-Stage Least Squares model, accounting for both time-period and project fixed effects. The authors’ results indicated that according to the objectives of projects, a proper and planned control for the communication among team members is crucial for the success of OSS projects.

KEYWORDS

Communication Patterns, Open Source, Panel Data Analysis, Social Network Analysis, Success, Three-Stage Least Squares

1. INTRODUCTION

As an increasingly popular example of open innovation, open source software (OSS) has garnered increasing attention not only from practitioners, but also from academic scholars who are interested in examining this phenomenon in a rigorous in-depth manner (e.g., Crowston, Annabi, & Howison, 2003; Daniel, Agarwal, & Stewart, 2013; Grewal, Lilien, & Mallapragada, 2006; Sen, Singh, & Borle, 2012; Subramaniam, Sen, & Nelson, 2009; Temizkan & Kumar, 2015; Zhang, Hahn, & De, 2013). Given that the shared technology in OSS community is available to potential buyers at little or no cost, and it is typically created within OSS projects, one key area of academic interest in OSS is the...
understanding of the success of OSS projects (Temizkan & Kumar, 2015). Based on the theoretical lens of economics and social network, extant related studies examined the determinants of OSS projects’ success from project, team, and third-party perspectives (Daniel et al., 2013; Grewal et al., 2006; Sen et al., 2012; Subramaniam et al., 2009). Although the characteristics of layered organizational structure and incentive mechanism (Zhang et al., 2013) make OSS teams operate like organizations, the literature on explaining the OSS projects’ success based on organizational theory is sparse. In addition, the voluntary participation characteristic (Temizkan & Kumar, 2015) makes OSS teams harder on effective communication than general organizations. For the OSS teams, to achieve their objectives and successfully complete their tasks, information must be effectively exchanged. Besides, the global distribution of contributors increases the challenge and importance of effective communication among developers with different cultures (Siau & Tian, 2013). Communication and coordination therefore have been found to be two major aspects that significantly affect the performance of such teams (Temizkan & Kumar, 2015). To this end, we focus on the impacts of communication patterns (which is adapted from theory of communication in organizational theory) on the success of OSS projects.

Prior studies have examined the impacts of communication patterns on the formation of new OSS development teams (Hahn, Moon, & Zhang, 2008), the stability of developer networks (Oh & Jeon, 2007), developers’ dynamics learning (Singh, Tan, & Youn, 2011), the effectiveness of OSS teams (K.J. Stewart & Gosain, 2006), the success of OSS projects (Singh, Tan, & Mookerjee, 2011; Temizkan & Kumar, 2015), and the adoption of innovative artifacts (Singh & Phelps, 2013). These studies exclusively focused on the relationship among heterogeneous contributors or projects. However, individuals with different interests and capabilities participate in the OSS community with heterogeneous levels of intensity and play different roles (Zhang et al., 2013). Extant research showed that various roles in OSS community would lead to different sustainable participation (Zhang et al., 2013), contribution to the OSS development (Setia, Rajagopalan, Sambamurthy, & Calantone, 2012), and economic returns (Hann, Roberts, & Slaughter, 2013). In addition, the effectiveness of different roles in the OSS teams will definitely bring different contributions for the success of OSS projects. Based on the general criteria of decision rights and responsibilities in OSS teams, project managers (i.e., the contributors who manage and coordinate the projects) play more critical roles in the development process than other members (i.e., the contributors who does not have administrative rights and responsibilities) (Zhang et al., 2013).

Observing these two research gaps in OSS field, we bridge these two research streams to investigate how the interaction between communication patterns and developers’ roles in development teams affects the success of OSS projects. In addition, we examine this effect in a long term window, which complements our understanding about the longitudinal success of OSS projects (Subramaniam et al., 2009). By doing so, this study is expected to provide an understanding as to how communication patterns established in different roles (i.e., project leaders and members) and different levels (i.e., projects and leaders’ perspectives) determine the success of an OSS project in a long term manner. Like most previous studies, we measure OSS projects’ success from both developers (i.e., development activities) and users (i.e., popularity) perspectives (Grewal et al., 2006; Stewart, Ammeter, & Maruping, 2006; Wen, Forman, & Graham, 2013). However, we extend the existing research by including the potential relationships among these success measures in our estimation model, which is different from extant studies that considered the success measures as independent of one another. To empirically study the research question, we collect longitudinal data from SourceForge.net to capture the dynamics of OSS projects over time, which allows us to account for changes within OSS projects and differences among OSS projects (Subramaniam et al., 2009). Following the panel data analysis methodology, we obtain econometric analysis results from the Three-Stage Least Squares
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