Chapter 2
A Study of Open Source Software Development from Control Perspective

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ABSTRACT

Open source software (OSS) has achieved great success and exerted significant impact on the software industry. OSS development takes online community as its organizational form, and developers voluntarily work for the project. In the project execution process, control aligns individual behaviors toward the organizational goals via the Internet and becomes critical to the success of OSS projects. This paper investigates the control modes in OSS project communities, and their effects on project performance. Based on a web survey and archival data from OSS projects, it is revealed that three types of control modes, that is, outcome, clanship, and self-control, are effective in an OSS project community. The study contributes to a better understanding of OSS project organizations and processes, and provides advice for OSS development.

INTRODUCTION

The past decade has seen a marked expansion in the open source software (OSS) movement. The open source initiative sprung from the idea that software should be free and open. OSS contrasts with the traditional software distribution model, in which computer software is sold only with a license to use precompiled binary code without giving users the access to the source code. OSS, on the other hand, is licensed to guarantee free access to the source code, often under a license that sets conditions for modification, reuse, and re-distribution (Bretthauer, 2002). The concept

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of copyleft is the core to OSS. To copyleft a program, the programmer, besides copyrighting the program to himself, also signs a General Public License (GPL) granting everyone the right to use, modify, and distribute the program on the condition that the license also grants similar rights over the modifications he or she has made. Under this arrangement, everyone has free access to the program but it is protected from becoming someone's private intellectual property (Lerner & Tirole, 2002).

Open source software is the result of Web-based collaboration. Once started, an OSS project is usually accomplished by a community of participants that are geographically dispersed and communicate through the Internet (Lee & Cole, 2003), which makes OSS different from traditional software development in both organizing and process (Feller & Fitzgerald, 2002). Today, numerous open source projects are categorized into three types: (1) community projects, which are completely online community based, involving voluntary software developers; (2) non-profit organization projects that have matured to the level where they can get funding towards a more formal organization but still maintain some features of community projects (e.g. Apache Software Foundation), in which developers can be either paid workers or volunteers; and, (3) commercial projects sponsored by companies like IBM, HP, SUN, etc., in which major contributors are paid developers from the companies (Fitzgerald, 2006). Currently, most of the open source projects belong to the community projects category, and most of the successful software products (e.g. Linux, Apache) used to be community projects in their initial stages, although some of them took on the non-profit organization or commercial project model after they became very popular. Thus, in this paper we choose community projects as the target for research, and refer open source software to those developed by online communities of volunteers.

Open source project participation is developers' voluntary actions. The motivations for project participation include reputation gaining, job prospects, enjoyment, learning purpose, cooperation needs, open source ideology, and personal software needs (Hars & Ou, 2002; Roberts, Hann, & Slaughter, 2006; von Hippel, & von Krogh, 2003). And each member in an open source project community may have different motivations for participation (Wu, Gerlach, & Young, 2007). However, it has been demonstrated that although OSS development is a process of voluntary activities, the developers' behaviors can be affected by the project environment, such as the values, beliefs, and norms in project community (Stewart & Gosain, 2006), interpersonal relationship between developers (Xu, Jones, & Shao, 2009), and satisfaction of developers' psychological needs (Agerfalk & Fitzgerald, 2008). Thus, the development activities of an OSS project can be regulated to some extent although the project takes online community as its organizational form.

In traditional software development teams, how to control members' behaviors to align them with the goals of the project is critical to project success (Henderson & Lee, 1992; Kirsch, 1996, 1997). It has been demonstrated that control mechanisms play an important role in the governance and management of software development internally within an organization (Nidumolu & Subramani, 2003) and externally between alliances (Choudhury & Sabherwal, 2003). Both formal and informal control modes are used in traditional organizations and software development teams (Kirsch, 1996; Ouchi, 1980). The formal controls depend on the formal rules, procedures and evaluations, while informal controls depend on the factors like cultures, values, beliefs and members' self-regulation. OSS development is significantly different from traditional software development in both organizational form and process. Previous research indicated that in OSS project communities there exists some types of governance that take effects as controls in traditional organizations, and they