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Explaining Perceived Turnover in Open Source Software Projects based on Hygiene Factors

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ABSTRACT

The success of open source software (OSS) projects heavily depends on sustained participation of project members. However, turnover of members and the ensuing instability have become very common. To better understand the turnover of members in OSS projects, we base our study on Herzberg's two-factor theory to investigate whether hygiene factors will lead to members' dissatisfaction. At the same time, we draw on Mobley's model of withdrawal decision process to hypothesize the relationship between dissatisfaction and perceived turnover. We develop a research model and present hypotheses that should be tested in the future. To empirically assess this model, we intend to survey OSS project members through the largest development platform Sourceforge. This study will provide a new insight into how the turnover of members emerges in OSS projects. The findings of this progressive research will have implications for both practice and theory.

Keywords

Open source software projects, members' turnover, dissatisfaction, hygiene factors, volunteers.

INTRODUCTION

Open source software (OSS) development has been an innovative software programming and distribution practice over the last two decades. A typical OSS project thrives mainly upon the free contributions from its developer community. Hence, it is critical for these projects to retain the existing developer community and attract new members (Midha and Palvia, 2007). Considerable studies have focused on participation of OSS development and motivations thereof (von Krogh and von Hippel, 2006). Nevertheless, merely concentrating on participation is far from enough since a great number of members choose to quit after having made only a few contributions. This phenomenon is termed as the turnover of members in OSS projects in this analysis. Perceived turnover, which represents a latent construct, emerges prior to the actual turnover. Only recently have some studies been dedicated to examine this phenomenon. Initial conditions to participate did not effectively predict long-term participation (Fang and Neufeld, 2009). However, Wu, Gerlach and Young (2007) found that helping behavior and economic incentives affect developers' intentions to continue with OSS development. Besides, complexity and lower modularity of the software translate into lower developer retention and more time to fix bugs (Midha and Palvia, 2007).

Voluntary turnover is usually described as a deliberate, job-dissatisfaction-initiated process that includes job search and subsequent expected utility deliberations (Weller, Holtom, Matiaske, and Mellewigt, 2009). Traditional turnover perspectives focus on perceived desirability and ease of movement. However, it has limited success in explaining turnover. Mobley (1977) firstly investigated the psychology of the withdrawal decision process and identified possible intermediate linkages in the satisfaction-turnover relationship. From the parallel perspective, Lee, Wise and Fireman (1996) argued that people used different decision paths with possible combinations of shocks (or not shocks) and the cognitive activities when leaving an organization. Recently, turnover has just been successfully modeled by recognizing that job (dis)satisfaction and ease of movement importance depend on the group of leavers being studied (Lee, Gerhart, Weller, and Trevor, 2008). Reilly (2005) argued that dissatisfaction could lead to turnover.

In line with these previous studies, we choose dissatisfaction as the linkage between influential factors and perceived turnover, and apply these theoretical links to the context of OSS projects. This research is based on Herzberg’s two-factor theory and Mobley’s model of job (dis)satisfaction and turnover. The former theory accounts for the derivation of influential factors and the latter accounts for the relationship between dissatisfaction and perceived turnover. From the perspective of OSS development, our study is the first operational analysis bridging the gap between dissatisfaction and perceived turnover psychologically. If these factors can be anticipated and manipulated, project administrators could take preventative actions to decrease the forthcoming turnover.

RESEARCH MODEL

Herzberg’s two-factor theory maintains that job satisfaction and dissatisfaction are not on a continuum with one increasing as the other diminishes, but are independent phenomena (i.e. an increase in satisfaction does not necessarily lead to decrease in dissatisfaction). The factors that lead to satisfaction are termed as motivators, while the others that lead to dissatisfaction are termed as hygiene factors (Herzberg, 1968). Likewise, in the OSS context, the motivation of participation are not necessarily the very influential factors of dissatisfaction (though some may be overlapped), hence dissatisfaction couldn’t be measured by the extant system of motivation which evoke participation. We expect to, just as the project administrators do, avoid dissatisfaction as much as possible, and to retain the experienced members and make them contribute to the project in a sustainable way. As a result, it is essential to identify and examine these hygiene factors, i.e., influential factors of dissatisfaction, in OSS projects.

Herzberg pointed out that the major hygiene factors were company policy and administration, supervision, salary, interpersonal relations and working conditions (Herzberg, 1968). We do not aim to comprehensively search for all the influential factors of dissatisfaction, rather practically derive them from aforementioned major hygiene factors because it makes the administrators’ supervision and influence more controllable. In the context of OSS, we retain all these major factors except for working conditions, since members are free to determine the working environment by themselves and are not confined in a fixed place. In this sense, they will not feel constrained to do the committing work and are unlikely to complain of the working conditions. As for other three major hygiene factors, namely company policy and administration, supervision and interpersonal relations, we pinpoint their counterparts in OSS context, and they are respectively project regulation and administration, support and relationships with other project members.

To derive our hypotheses, we draw on expectation-disconfirmation theory (EDT) that, in its original context, posits that expectations, coupled with perceived performance, lead to post-purchase satisfaction. This effect is mediated through positive or negative disconfirmation between expectations and performance. If a product does not live up to expectations (negative disconfirmation), the consumer is likely to be dissatisfied (Oliver, 1980; Spreng, MacKenzie, and Olshavsky, 1996). Likewise, in the OSS context, we argue that if perceived experiences regarding each hygiene factor fall short of members’ initial expectations (negative disconfirmation), dissatisfaction will be induced.

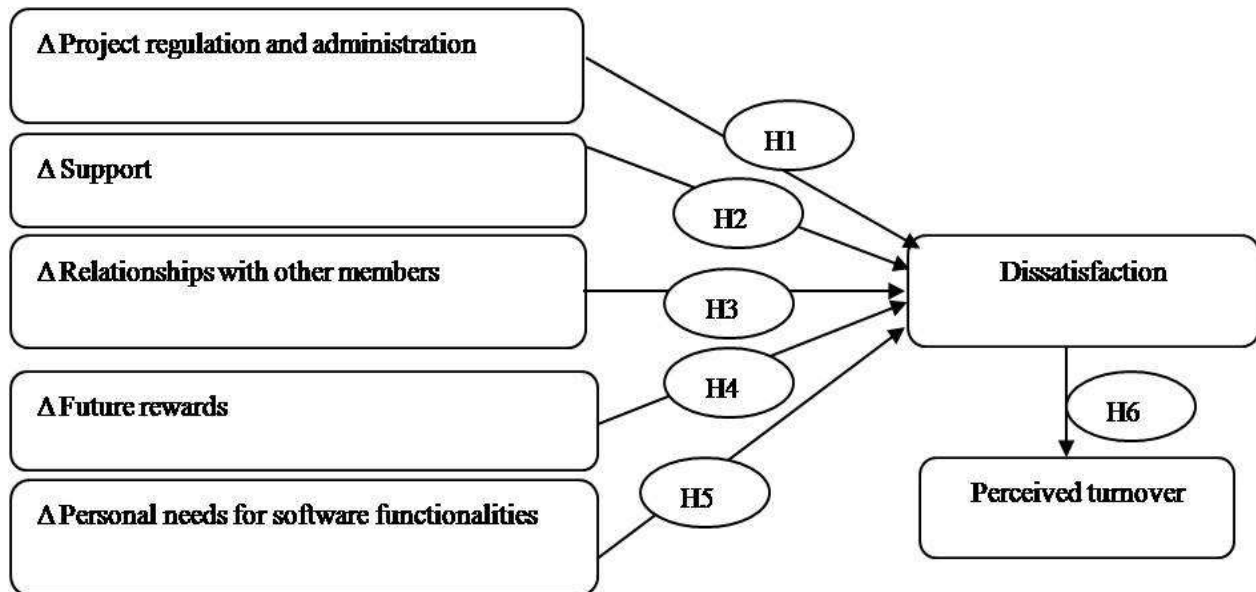


Figure 1. Research Model of Perceived Turnover in OSS Projects Based on the Hygiene Factors

The research model is presented in Figure 1. “ Δ ” conveys the differential between the members’ initial expectations and perceived experiences of each hygiene factor when the latter fails to live up to the former. Thus, we propose the following hypotheses:

H1: *The negative disconfirmation of project regulation and administration is positively related to OSS project members’ dissatisfaction.*

H2: *The negative disconfirmation of support is positively related to OSS project members’ dissatisfaction.*

H3: *The negative disconfirmation of relationships with other members is positively related to OSS project members’ dissatisfaction.*

Moreover, subjects of our analysis are the majority who are not paid among all the members contributing to OSS projects. Accordingly, we utilize the alternative “future rewards” which involves potential revenues from products or services, career advancement, peer recognition and human capital enhancement (Hars and Ou, 2002). Then the fourth hypothesis ensues:

H4: *The negative disconfirmation of future rewards is positively related to OSS project members’ dissatisfaction.*

Meanwhile, the hygiene factors are external ones which are closely correlated with dissatisfaction (Herzberg, 1968). Hence the factor of personal needs for software functionalities is integrated into the model:

H5: *The negative disconfirmation of personal needs for software functionalities is positively related to OSS project members’ dissatisfaction.*

Mobley’s model (1977) presented the intermediate linkages in the relationship between job (dis)satisfaction and turnover. He detailed the process of decision processes of quitting in a psychological and causal way. But it is heuristic, and non-descriptive (there may well be individual differences in the number and sequence of steps in the withdrawal decision process). Indeed the intermediate linkages between job (dis)satisfaction and intention to quit/ stay involve searching for an alternative, which, however, in the OSS context, does not exist, because our research object is the quintessential voluntary members who account for the large proportion of the entire participants (Lerner and Tirole, 2002), i.e., if they are dissatisfied with this voluntary job, they may well choose to quit without making an effort to search for an alternative, since most of them have a formal job and just take this volunteer job out of interest or personal need for software features and so on. Quit will not incur pecuniary loss. Consequently, we tailor Mobley’s model into the OSS context in this way (Figure 2).



Figure 2. Mobley’s Model on Employee Turnover

Mobley (1977) stated that high negative correlations between satisfaction and frequency of thinking of quitting had been found. Atchinson and Lefferts (1972) found that the frequency with which people thought about quitting their job was significantly related to actual termination. It is apparent that perceived turnover is the prelude of actual turnover. As a result, we argue that perceived turnover results from members’ intention to quit and frequency of thinking quitting. That is to say, perceived turnover embodies members’ leaving intention. Furthermore, if we relate it to the theory of reasoned action, simply put, intention leads to behavior (Ajzen and Fishbein, 1980), it will be evident that perceived turnover is an effective prediction of actual turnover. That’s why we focus on perceived turnover.

Additionally, in the OSS context, members usually do not resort to absenteeism or passive job behavior to alleviate dissatisfaction, just quitting is a more logical alternative. Therefore, we postulate that only under the circumstances that members are dissatisfied with the previous work (different from “not satisfied”), will they choose to quit and hypothesize that the perceived turnover is directly related to dissatisfaction.

H6: *OSS members’ dissatisfaction with their work is positively related to perceived turnover.*

RESEARCH METHODOLOGY

We plan to test the hypotheses empirically. The constructs of the hygiene factors shown in Table 1 were grounded on an extensive literature review. The significance of this review lies in that, it not only transfers Herzberg’s hygiene factors to OSS context, but also advances the model to be tested.

<i>Hygiene factors found out by Herzberg:</i>	<i>Hygiene factors to be examined in OSS projects:</i>	<i>Constructs of hygiene factors in OSS projects:</i>
Company policy and administration	Project regulation and administration	Lines of communications (Herzberg, 1968); Procedures of submitting codes (Herzberg, 1968); Delegation of power (Herzberg, 1968, Mateos-Garcia and Steinmueller, 2008)
Supervision	Support	Technical support from core members (Lee, 2004); Technical support from peers (Lee, 2004)
Relationship with boss	Relationships with other members	Being trusted by core members and peers (Gallivan, 2001); Disagreement (Fang and Neufeld, 2009)
Relationship with peers		
Salary	Future rewards	Potential revenues from products or services (Hars and Ou, 2002); Career advancement (Hars and Ou, 2002); Peer recognition (Hars and Ou, 2002); Human capital enhancement (Hars and Ou, 2002)
–	Personal needs for software functionalities	Match of software functionalities and specific needs (Hars and Ou, 2002); Ability to fix problems with software (Hars and Ou, 2002)

Table 1. Factors Inducing Dissatisfaction in OSS Projects

In order to measure the constructs derived from five hygiene factors, we still need to generate items. They will focus on the discrepancy between respondents' initial expectations before participating in the projects and actual experiences. For example, regarding the construct of "human capital enhancement", the respondents should report how likely they expected acquiring knowledge from the OSS projects, and meanwhile, how they evaluate the present condition of acquiring knowledge. These items will be measured on the 7 point-Likert scales ranging from "strongly disagree" to "strongly agree" for expectation and "very poor" to "very good" for perception of experiences. The items about the dissatisfaction will elicit their overall dissatisfaction with their work in the past, while the items about perceived turnover will focus on the frequency of thinking of quitting and thereby we can infer their potential behavior. In addition, we will choose tenure as the control variable, because it influences the members' perception of experiences in the OSS projects.

Data source will be surveys using a questionnaire comprising questions asking respondents to feedback expectations, perceived experiences, dissatisfaction and frequency of thinking of quitting. We plan to draw samples from the projects hosted on the largest OSS development platform www.sourceforge.net. The members of each OSS project will be targeted as potential subjects. Participation will be requested via an E-mail which describes the purpose of the study, a request for voluntary participation and a hyperlink to an online survey form. Regarding the assessment of our research model, construct reliability, validity, and hypotheses testing are intended to be analyzed with structure model equation based on partial least squares.

POTENTIAL CONTRIBUTIONS

We expect to find out whether OSS project members' dissatisfaction will have an influence on perceived turnover in an OSS project based on the verification of the hygiene factors' influence on dissatisfaction.

In theoretical side

On one hand, this study will shed light on the drivers of perceived turnover in OSS projects from the perspective of cognition which is a gap in OSS literature. On the other hand, the relationship between dissatisfaction and turnover has not been established for volunteers, whereas this study will fill in this research gap, since the subjects of our analysis are OSS volunteers.

In practical side

By virtue of the predictive perceived turnover (we have justified hereinabove), it is operational for project administrators to take precautionary measures to minimize the actual turnover which likely ensues. When it comes to administrators' countermeasures, hygiene factors play an important role. The practical implication lies in that the hygiene factors are the

criteria of avoiding dissatisfaction. Some of the hygiene factors, namely, project regulation and administration, support, and relationships can be adjusted and optimized by project administrators to retain experienced and loyal members.

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