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83. Motivation, Social Identity and Ideology Conviction in OSS Communities: The Mediating Role of Effort Intensity and Goal Commitment

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Abstract

Research has found salient individual and social motivating factors that influence participants' involvement and contribution to OSS projects. Yet, these factors were examined independently from each other, and the mechanisms of their impacts were unclear. This paper is a first attempt to have a better and complete understanding of the phenomenon. We theorize an integrated model on the effects of personal motivation, social identity and ideology conviction on individuals' task performance in and satisfaction with open source software projects. In particular, we posit that these motivating factors are translated into performance and satisfaction through effort intensity and goal commitment. Also, we contend that task performance positively affects an individual's satisfaction with a specific OSS project.

Keywords: Open source software, motivation, task effort, performance, satisfaction

Introduction

Open source software (OSS) projects, such as Linux and Apache, have achieved remarkable success. A metaphor for the difference between OSS and the proprietary software development styles is “the cathedral and the bazaar” (Raymond, 1999). The cathedral model of the proprietary software development is tightly organized and centrally planned. In contrast, the development model of OSS resembles “a great babbling bazaar of differing agendas and approaches” (Raymond, 1999). In particular, OSS projects are usually initiated by an individual or a group that wants to develop a software product to meet their own needs and the creation of these projects is a public good distributed with little or no cost via the Internet (Fitzgerald, 2006; Gacek and Arief, 2004; Lakhani and von Hippel, 2003; von Krogh and von Hippel, 2006). Anyone and everyone can immediately obtain, test, and enhance the freely revealed new software. Thus, OSS projects involve only light coordination activities and have no roadmaps or milestones or other control mechanisms (Lee and Cole, 2003; von Krogh and von Hippel, 2006). In addition, the rapid sharing and collaborative improvement make it possible for OSS communities to achieve widespread and cost-free diffusion of innovations that meet heterogeneous user requirements (Fitzgerald, 2006; von Krogh and von Hippel, 2006). These projects are fundamentally different organizational models for innovation and are referred to as private-collective innovations (Niederman and Davis, 2006; von Hippel and von Krogh, 2003) and community-based innovations (Franke and von Hippel, 2003; Lee and Cole, 2003; Shah, 2006).

Since the turn of the century, there is a surge of interest in studying how OSS projects succeed with little organizational control and lack of remuneration systems (von Hippel and

von Krogh, 2003; von Krogh and von Hippel, 2006). Since individuals' participation and engagement are critical to an OSS group's viability and sustainability, questions such as "What are the factors driving participants to contribute to OSS communities" and "How do OSS project groups keep these participants remain engaged in the communities" are of great interest to researchers and practitioners (e.g., (Bagozzi and Dholakia, 2006; Bergquist and Ljungberg, 2001; Hann, et al., 2002; Hars and Ou, 2002; Hertel, et al., 2003; von Hippel and von Krogh, 2003; Zeitlyn, 2003). From a personal perspective, studies found that participation in OSS projects were driven by intrinsic and/or extrinsic motivation (Hars and Ou, 2002; Lakhani and Wolf, 2005; Roberts, et al., 2006). From a social perspective, research found that the conviction of the ideology associated with OSS development (Lakhani, et al., 2002; Markus, et al., 2000; Stewart and Gosain, 2006) and the identification with OSS project groups (Bagozzi and Dholakia, 2006; Hertel, et al., 2003) served as lynchpins in enabling OSS efforts and success.

However, the extant literature did not provide a fuller picture by considering personal motivation, ideology conviction and social identity's effects in a single model. Although these factors can be complementary to each other, they each depict the phenomenon from a different angle. Personal motivation relates an individual to tasks incurred in OSS communities; ideology conviction leads and enables the individual to be committed with the goal of making software free; and social identity connects the individual with a specific OSS community. The three aspects thus can collectively explain why an individual participates and remains engaged in a specific OSS project.

In addition, the extant literature assesses the direct effect of each of these three salient factors on individuals' participation and/or contribution in OSS projects (e.g., (Hars and Ou, 2002; Roberts, et al., 2006; Shah, 2006). There is no prior study examining the underlying influencing processes of these motivating factors. This lack of understanding of underlying processes may be the reason for some inconsistent and controversial research findings. For example, Roberts et al. (2006) found that intrinsic motivation had no significant effect on participants' contribution level; but Shah (2006) found that it was intrinsic motivation that drove developers to remain engaged in the project; Lakhani and Wolf (2005) also found evidence in favor of intrinsic motivation as the driving force. Thus, it is important to study how possible factors mediate the relationships between the motivating factors and individuals' participation in and/or contribution to OSS projects. Furthermore, to our best knowledge, few prior studies assessed positive psychological values such as satisfaction that participants may gain from their OSS projects. We submit that satisfaction with OSS projects is critical to reinforce participants' motivation and social identification with their project groups and to keep them engaged in OSS projects. Therefore individuals' satisfaction experienced in their OSS participation warrants scrutiny.

In this paper, we theorize the process of how all three motivating factors, namely personal motivation, ideological conviction and social identification, influence individuals' performance in and satisfaction with OSS projects. We derive a research framework that applies theories in motivation, social identification, information systems and social psychology. In particular, drawing upon motivation and psychology theories (Locke et al. 1976; Parsons 1968), we contend that these motivating factors' effects on performance and satisfaction are mediated by task effort (i.e., effort intensity and goal commitment). The objectives of this study is to provide an integrated model about how motivating factors affect individuals' performance and satisfaction in OSS communities; examine how different

dimensions of task effort are related with different motivating factors; and study how these antecedents affect participants' psychological value (i.e., satisfaction with the project).

Literature Review

OSS projects, as a community-based innovation (Franke and von Hippel, 2003; Shah, 2006), are exemplars of organizational models for innovation and product development (Franke and von Hippel, 2003; Shah, 2006; von Hippel and von Krogh, 2003). The distinction of OSS projects is that they generally are initiated by software users/developers. The participants of OSS projects, most likely volunteers, communicate with each other and distribute their creation of software programs through the Internet. Peers test, comment, and probably modify the codes and publish the enhanced versions of the programs (Lee and Cole, 2003). In addition to making contributions by code writing, bug reporting, and requesting for new functions/features, participants may also provide services that are mundane but critical for the viability of the communities, such as enlisting and helping new members. Without the presence of traditional organizational structures of control, OSS projects' viability and sustainability rely on participants' self-managing contributions (Stewart, et al., 2006). Therefore, studying what factors and how these factors lead individuals to participate and remain engaged helps us understand OSS projects' success (Bagozzi and Dholakia, 2006). In the extant literature, the salient factors include personal motivation, the conviction of OSS ideology and social identification with OSS groups (e.g., Roberts et al. 2006; Shah 2006; Bagozzi and Dholakia 2006; Hars and Ou 2002; Hertel et al. 2003; Stewart and Gosain, 2006). In the following sections, we provide an overview of the related theories and empirical findings on these three aspects in OSS research.

Personal Motivation

Motivation is the psychological force within an individual that determines the direction of the individual's behavior, the individual's level of effort, and the individual's level of persistence in the face of obstacles (Kanfer 1990). Building on Vroom's (1964) expectancy-valence theory of motivation, Porter and Lawler (1968) proposed a model of intrinsic and extrinsic motivation. Intrinsic motivation involves an individual doing an activity for his or her immediate need satisfaction and it "is valued for its own sake and appears to be self sustained (Deci 1975, p. 105). In contrast, extrinsic motivation requires an instrumentality between the activity and some separable consequences. Therefore, extrinsic motivation involves an individual's undertaking an activity to satisfy his or her needs indirectly. According to motivation theories, intrinsic motivation mobilizes an individual's effort in performing relevant tasks that are enjoyable and cognitively challenging, and satisfy the individual's need for competence and self-determination (Deci and Ryan 2000). Therefore, intrinsic motivation is correlated with both creativity and level of effort devoted to relevant tasks (Amabile, et al., 1994). Similarly, extrinsic motivation is found to drive individuals to work harder (Amabile et al. 1994). However, the effect of intrinsic and extrinsic motivation can be very different due to their different motivating mechanisms. A detailed discussion of the interrelationship between intrinsic and extrinsic motivation is beyond the scope of this paper (see details at Amabile et al. 1994).

In the context of OSS, motivation, as the driver for individuals' initial and continued engagement, effort and contribution, is expected to play a critical role in affecting OSS project success (Hertel et al. 2003; Roberts et al. 2006; Shah 2006; von Hippel and von Krogh 2003; Hars and Ou 2002). Indeed, there are extensive empirical studies supporting the significant influences of intrinsic and extrinsic motivations on individuals' participation in

OSS communities (e.g., Hars and Ou 2002; Hertel et al. 2003). In particular, OSS community participants' intrinsic motivation is found to include seeking for challenges, enjoyment, learning, and a sense of obligation to contribute back to the community (Ghosh 1998; Shah 2006; Hertel et al. 2003; Hars and Ou 2002); while extrinsic motivation includes participants' own software needs, career concerns, and reputation and status in the community (Hann et al. 2002; Raymond 1999; Franke and von Hippel 2003; Lakhani and von Hippel 2003).

Social Identity

The central assumption underlying social identity theory (Tajfel, 1974; Tajfel, 1978) is that there are many social settings in which people primarily think of themselves and others in terms of particular group memberships, although in some social situations people think of themselves as independent individuals who interact with each other on the basis of personal characteristics or preferences. There are three processes that underlie group-based social interaction, namely, social categorization, social comparison and social identification (Ellemers, et al., 2004; Ellemers, et al., 1999). Social categorization refers to the notion that in many situations people organize social information by categorizing individuals into groups. Social comparison is the process by which a social categorization is invested with meaning. Social identification is the process by which information about social groups is related to the self (Ellemers, et al., 2004).

Social identities instigate individuals to perform behaviors for the benefits of group members (Ellemers et al. 1999; Bagozzi and Lee 2002) and take the group's goal as their own. For example, aspects of social identity influence in-group favoritism (Bagozzi and Lee 2002). Similarly, it is found that, due to their identification with organizations, individuals may discretionarily conduct tasks that are above and beyond the call of duty and are not rewarded by the organization's reward system (Konovsky and Pugh, 1994). Therefore, when individuals work in groups, their behavior is influenced by their social identity, in addition to their individual preference and motives (Allen and Meyer, 1996; Bagozzi and Lee, 2002).

In the context of OSS project groups, identification with the collectives help explain why individuals perform tasks that are mundane, time consuming and unlikely to garner prestige (Bagozzi and Dholakia, 2006; Hertel, et al., 2003; Lakhani and von Hippel, 2003). Examples of this type of tasks in the OSS context are providing unpaid assistance and advocacy to enlist and help new users, providing field support for other members of the group, and contributing their own money to run advertisement for the group (Bagozzi and Dholakia 2006). Therefore, we need to go beyond the personal motivation to study what influence OSS participants to perform well and keep engaged in OSS groups (Bagozzi and Dholakia 2006). Indeed, recent studies of OSS found that OSS communities play a critical role in motivating developers to contribute to OSS projects (e.g., Hars and Ou 2002; Lakhani and Wolf 2005; Bagozzi and Dholakia 2006). In particular, it has been found that social identification with the communities is an important factor leading the surveyed developers to contribute to OSS projects (Bagozzi and Dholakia 2006; Lakhani and Wolf 2005; Hars and Ou 2002).

Ideology

Ideology is defined as "shared, relatively coherently interrelated sets of emotionally charged beliefs, values and norms that bind some people together and help them make sense of their worlds" (Trice and Beyer, 1993). Ideology guides individuals in evaluating the legitimacy of their behavior (Trice and Beyer, 1993) and endorses relevant tasks with meaningfulness and significance (Kahn, 1990). When an individual identifies with an ideology, he or she

perceives the work aligned with this ideology to be rewarding and worthwhile. Therefore ideology conviction plays a motivating role in energizing individuals' effort towards a goal aligned with the ideology (Kirsch, 1997; Ouchi, 1979). In the context of OSS development, ideology may be even more important as a clan control mechanism as it is hard to observe participants' behavior and there exists no formal organizational control (Barker, 1999; Stewart and Gosain, 2006).

The OSS movement is ideologically rich in meaning (Elliott and Scacchi, forthcoming). For example, an argument advanced by many proponents of the OSS is that making the source code freely available helps increase the software's value to individual users, and to the society as a whole (Stallman, 2002), while proprietary software is immoral and can harm society. In particular, OSS makes it possible for more people to use the software, be able to adapt, learn from or base new work on the software, and therefore OSS development makes the software progress faster and more secure (Stallman 2002). As suggested by the literature, the conviction of OSS ideology makes individuals' participation in OSS projects purposeful and meaningful, namely contributing to OSS development, rather than just performing the task of participation per se. Indeed, OSS research found that ideology associated with OSS development is an important motivator for individuals' participation in OSS projects (Bagozzi and Dholakia, 2006; Ljungberg, 2000; Markus, et al., 2000; Stewart and Gosain, 2006).

In summary, there is extensive theoretical and empirical support for the notion that personal motivation, social identity and ideology conviction energize individuals to participate in OSS projects and make these projects succeed. However, no study has examined these motivating factors in a single integrated conceptual model. In addition, there is a lack of research studying the underlying mechanisms by which these salient factors lead to project success. Motivating factors are about individuals' psychological states, beliefs or affective attachments rather than actions that lead to contributions to OSS projects. According to motivation theory (Locke 1976; Parsons 1968), motivating factors affect performance outcomes though efforts expended on the task. Therefore, studying the mediating effect of task effort on the relationship between motivating factors and individuals' participation in and contribution to OSS projects may enrich our understanding of OSS project success. Furthermore, although researchers have established that affective consequences resulted from the participation in group activities is critical for individuals to keep engaged in that behavior (Allen and Meyer, 1990), the literature shows a dearth of attention on individuals' psychological values derived from their participation in OSS projects.

Theoretical Model and Propositions

As a first step toward a better understanding of the phenomenon, we theorize the underlying process of the three above-mentioned motivating factors on individuals' performance in and satisfaction with OSS projects, where their effects are mediated by individuals' task effort (i.e., effort intensity and goal commitment). As mentioned above, motivating factors are not actions that can lead to work outcomes directly; rather, they are translated into accomplished work by the means of effort (Parsons, 1968). In this study, performance is defined as the outcome of an individual's behavior in an OSS project (Mitchell and Daniels 2003). Following Locke's (1976), we define satisfaction with an OSS project as a pleasurable or positive emotional state which is a function of the perceived relationship between what one wants from participating in an OSS project and what one perceives it is offering.

Drawing upon theories in motivation and psychology (e.g., Locke 1976; Parsons 1968), and OSS literature, we propose that personal motivation’s effect on an individual’s performance in and satisfaction with an OSS project is mediated by effort intensity, while the effect of social identity and ideology conviction is mediated by both effort intensity and goal commitment. Also, we posit that task performance positively affects an individual’s satisfaction. To summarize, our theoretical model is shown in Figure 1.

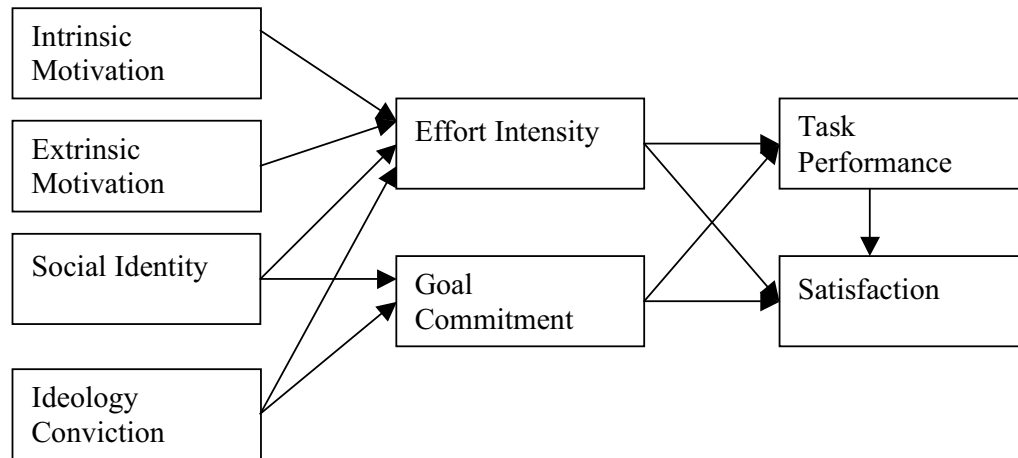


Figure 1 Theoretical Model

It is established that task effort consists of three components: goal commitment (or duration), intensity (or force) and direction (Kanfer, 1991). Effort intensity refers to the amount of resources that are expended. That is, effort intensity refers to how hard a person tries to carry out a chosen behavior (Kanfer, 1991; Yeo and Neal, 2004). Goal commitment is defined as “the determination to try for a goal and the persistence in pursuing it over time” (Hollenbeck, et al., 1989). Task direction is a person’s behavioral choice and is often measured as choice decisions between mutually exclusive courses of action (Kanfer 1991). This study focuses on the first two dimensions of task effort, in the view that we are interested in only individuals who participate in OSS projects and therefore people who are not OSS community participants are not of relevance to the current research. Also, effort intensity and goal commitment constitute the essence of working hard (Brown and Leigh, 1996).

We define effort intensity as the energy exerted per unit of time when an individual is participating in an OSS project. When effort intensity is high, the individual allocates a large portion of resources available to the task on hand and therefore may achieve good performance (Kanfer, 1991). Goal commitment refers to “the determination to try for a goal and the persistence in pursuing it over time” (Hollenbeck et al. 1989, P. 18). In OSS communities, project goals are usually set by project core teams or initial software developers (Markus, et al., 2000). Although the content of goals varies across different OSS projects, the central component of all OSS projects’ goals is the development of free software that meets users’ requirements (Stallman 2002). In this study, we define goal commitment as an

individual's determination and persistence in striving for the goal of a relevant project. Goal commitment is the binding of individuals to specific behavioral acts (Salancik, 1977). It manifests the extent to which the individual psychologically accepts the goal (Locke and Latham 1990). Therefore, an individual having a high level of goal commitment should try harder to achieve it and persist in that effort (Locke and Latham, 1988).

In OSS projects, individuals motivated by intrinsic motivation tend to seek meeting their need for competence and self-determination (Ryan and Deci, 2000) from their participating in OSS projects. Thus, these individuals can expend high levels of effort intensity when working on OSS projects. On the other hand, these individuals may focus too much on doing the tasks for the fun of doing them and overlook the bigger picture of the project goals (Thomas and Velthouse, 1990). Due to the lack of purpose at a higher level, these individuals' participation may be easily distracted by other activities, such as busy schedule at work. In addition, it is likely that these individuals do not need to commit to a specific OSS project because they can easily enjoy programming tasks with other OSS projects. Therefore, the individual may work hard on the OSS project (thus effort intensity), but not persistently work on a specific project. Similarly, extrinsic motivation drives an individual to work hard on the project so that he or she can get the expected reward, such as future career opportunity and reputation, but it cannot make the individual committed to the project's goal, which is set by others. Indeed, the individual is more likely to leave the OSS project group once he or she obtains the reward (Shah 2006). Hence, we expect that personal motivation is positively related with effort intensity but not with goal commitment.

Proposition 1 Intrinsic motivation positively affects individuals' effort intensity in OSS projects.

Proposition 2 Extrinsic motivation positively affects individuals' effort intensity in OSS projects.

On the other hand, social identity and ideology conviction should have positive effects on both effort intensity and goal commitment. Individuals with strong social identity of their OSS project groups should perceive the groups' goals as their own and expend effort on it (Allen and Meyer, 1996; Bagozzi and Lee, 2002). That is, social identity has positive effect on individuals' effort intensity and goal commitment in OSS projects. Similarly, individuals identifying with OSS ideology are more likely to be committed to the goal of software freedom. The ideal of creating greater value for the society, especially to software users, inspires these individuals to work hard and be persistent in their OSS project participation. Therefore, ideology conviction is positively related with individuals' effort intensity and goal commitment in an OSS project.

Proposition 3a Social identity positively affects individuals' effort intensity in OSS projects.

Proposition 3b Social identity positively affects individuals' goal commitment in OSS projects.

Proposition 4a Ideology conviction positively affects individuals' effort intensity in OSS projects.

Proposition 4b Ideology conviction positively affects individuals' goal commitment in OSS projects.

Parsons (1968) defined effort as the means by which motivation is translated into

accomplished work. This definition implies that effort plays a mediating role between motivation and work outcomes. Indeed, this mediating role of effort is empirically supported (Brown and Leigh, 1996; Brown and Peterson, 1994; Christen, et al., 2006). In particular, there is consistent theoretical and empirical support for effort's mediating role in antecedents' effect on performance (e.g., Brown and Leigh, 1996). Therefore, we propose that effort (i.e., effort intensity and goal commitment) mediates the relationship between the motivating factors and individuals' performance in OSS projects.

Proposition 5a *Effort intensity has positive effect on individuals' task performance in OSS projects.*

Proposition 5b *Goal commitment has positive effect on individuals' task performance in OSS projects.*

According to Cherrington (1980), there are two fundamental perspectives on the psychological value of work, i.e., work as an instrumental value and work as a terminal value. The instrumental value view regards work primarily as a means to an end. In contrast, the terminal perspective views work as a positive activity and thus work produces a feeling of dignity and self-respect (Cherrington, 1980). This perspective of work implies that effortful engagement in work has affective consequences, such as satisfaction. Indeed, there is empirical research supports that effort expended affects individuals' satisfaction with the work (e.g., Brown and Peterson 1994).

Although there are relatively scant studies on effort's direct effect on satisfaction, we posit that this effect may be especially significant in the OSS project context. In an OSS community, most OSS participants are volunteers and perform tasks at their own discretion. These participants may regard participating in OSS development as terminal value, rather than or in addition to a means to an end, that is, individuals derive psychological value from the work itself.

Proposition 6a *Effort intensity has a positive effect on an individual's satisfaction with OSS projects.*

Proposition 6b *Goal commitment has a positive effect on an individual's satisfaction with OSS projects.*

In addition, performance affects satisfaction and mediates the effects of antecedent variables on satisfaction (Brown and Peterson, 1994; Walker, et al., 1977). For individuals mobilized by personal motivations, good performance enables them get their basic needs satisfied or get the reward they expect; for individuals driven by social identity, good performance allows them to express themselves as members of the group and gain satisfaction from benefiting other members of the group; and for individuals energized by ideology conviction, good performance makes them affirm that they can make impact on the realization of OSS ideal and thereby feel satisfied. Thus, positive performance outcome provides the person with satisfaction, the affective feeling about the OSS project.

Proposition 7 *An individual's performance in an OSS project has a positive effect on the individual's satisfaction with the project.*

Discussion and Conclusion

In this paper, we theorize the process of three salient motivating factors' effects on OSS task

performance and satisfaction through task effort. Specially, we posit that effort intensity mediates the relationship between the antecedents, namely personal motivation, social identity and ideology conviction, and the consequences, i.e., an individual's task performance in and satisfaction with a specific OSS project, while goal commitment mediates the effect of social identity and ideology conviction on task performance and satisfaction. In addition, we contend that an individual's performance in an OSS project has positive impact on the individual's satisfaction. Our model and corresponding propositions are derived from the literature in organizational psychology, social psychology, motivation theories, and studies on OSS.

Our study makes three major theoretical contributions. First, this is the first study that incorporates all three motivating factors' effect in a single model to examine how they affect individuals' task performance in and satisfaction with OSS projects they participate. This integrated model provides a better picture about what drives individuals' engagement in and contribution to OSS projects, which are critical for OSS communities' viability and sustainability. Second, this study unveils how motivating factors are translated into achieved outcomes through task effort. Examining the mediating role played by task effort extend our understanding of the underlying influencing process of motivating factors in OSS communities and may help us explain the inconsistent and controversial empirical research findings on the importance of different motivating factors. Third, we theorize how motivating factors affect individuals' psychological value (i.e., satisfaction with the project), which is a critical issue that has been neglected by extant OSS research. While an individual's performance is instrumental for an OSS projects' success, psychological value gain from OSS project participation ensures that the individual's continued engagement in the project. Therefore, understanding antecedents of psychological value helps project leaders retain participants.

This research does have limitations that should be noted. First, the propositions articulated in the paper need to be tested empirically. Although we derive these propositions from extant literature, their validity may not remain in OSS context. After all, OSS communities are so different from traditional organizational models and our understanding of this new social value creating model is still limited. Future research should test the theoretical model proposed in this paper by data collected with participants of different OSS projects. Second, there are other salient factors that can affect an individual's performance in and satisfaction with an OSS project, such as the working style of the project leader and the individual's competence. While we try to provide an integrated model, we do not mean to provide an exhausted list of antecedents of individuals' performance and satisfaction. Future research should enrich the current theoretical model by examining other factors' effect and assessing the influence of possible moderators and mediators.

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