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Understanding Sustained Participation in Transactional Virtual Communities

Completed Research Paper

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Abstract

Two research gaps in prior studies on knowledge sharing in virtual communities (VCs) are identified. First, prior studies have focused on VCs with no explicit rewards system, whereas VCs using a competition-based reward system (e.g., transactional VCs) is not explored. Second, prior studies have concentrated on the determinants of initial participation rather than sustained participation. In this study, considering that a social learning process is involved in sustained participation, task complexity and self-efficacy – two social learning factors – are proposed to moderate the relationship between motivations and sustained participation. A field survey with 205 subjects in a transactional virtual community was conducted to test the research model. According to findings, extrinsic and intrinsic motivations significantly influence knowledge sharing intention. Negative interaction effect between extrinsic motivation and task complexity, as well as positive interaction effect between intrinsic motivation and self-efficacy, are observed as well. Implications and future research are discussed.

Keywords: Transactional virtual community, knowledge sharing, social learning, expectancy-value theory, sustained participation

Introduction

Virtual communities (VCs) as an important Internet-based platform to facilitate knowledge sharing among individuals have been widely discussed in information systems (IS) research (Bieber et al., 2002; Chiu et al., 2006; Hsu et al., 2007; Koh and Kim, 2004; Wasko and Faraj, 2000). Knowledge contributors in VCs share their knowledge with others based on a mechanism of “gift-giving” (Bergquist and Ljungberg 2001; Ljungberg 2000) or reciprocity (Wasko and Faraj, 2000). However, as knowledge provided by participants is deemed a public good (Wasko and Faraj, 2000) that is free to all, no economic value is generated. This serves as an impetus for researchers and practitioners to explore a new VC business model to extract economic value from shared knowledge (Armstrong and Hagel, 1996; Balasubramanian and Mahajan, 2001; Lechner and Hummel, 2002).

Since 2005, a new form of virtual community supporting the realization of economic value has emerged and rapidly developed worldwide. Popular applications include Amazon’s Mechanical Turk and myTino.com in the USA, as well as Taskcn.com and Witkey.com in China. In these VCs, knowledge seekers post tasks and extend certain monetary compensations in sourcing others’ knowledge to resolve problems, while problem solvers participate in these tasks and compete with other solvers to earn monetary rewards. In other words, unlike knowledge sharing in previous VCs, knowledge contributors in these VCs leverage their knowledge to gain payment through a competition-based reward system. Since knowledge exchange in this context is considered a transaction, this new type of VC is termed transactional virtual community (TVC).

This new application has achieved enormous success over the past several years. For example, over 20 websites have adopted this business model in China. A typical website, Taskcn.com, currently has over 2.8 million solvers, over 39,000 tasks, and over 4 million US dollars in task rewards. Likewise, over 178,000 knowledge-sourcing requests, human intellectual tasks in their terms, have been posted on Amazon’s Mechanical Turk.

The immense business potential of this new form of VC has urged both scholars and practitioners to consider how it could be sustained. Since the existence and sustainment of VCs heavily rely on ongoing participation of knowledge contributors who share their expertise (Fang and Neufeld, 2009; Roberts et al., 2006), their continuous participation in knowledge sharing becomes a critical success factor. However, turnover rate of solvers remains a significant challenge for the survival of TVCs. As numerous solvers compete to gain the rewards yet a mere handful could win in the end, those who frequently lose in the competition may quit from the TVC websites. For example, Taskcn.com has over 2.8 million registered members, but a mere 0.24 million (less than 10%) gain income through continued participation in online tasks. Furthermore, active solvers only occupy a minimal part of the total number of solvers. Therefore, understanding the factors that influence solvers’ sustained sharing behavior in TVCs is critical. This constitutes the objective of the present study.

Prior related studies have identified that extrinsic and intrinsic motivations are important factors leading to initial participation in knowledge sharing in VCs (Bock et al., 2005; Chiu et al., 2006; Daugherty et al., 2005; Hsu et al., 2007; Kankanhalli et al., 2005; Wasko and Faraj, 2000). In understanding sustained participation in TVCs, the present study builds on, yet exceeds these findings by presenting two important theoretical distinctions. First, this study focuses on knowledge sharing in TVC, a new form of VC managed by a competition-based reward system, in contrast to previously studied organizational settings or VCs with no explicit reward systems. Such contextual differences lead to different explanations on the salience of intrinsic versus extrinsic motivation mechanisms underlying knowledge sharing behavior, as will be discussed later in the paper.

Second, this study addresses sustained participation, rather than initial participation, in knowledge sharing. Factors depicted as important for initial participation may be inadequate to explain sustained participation. In fact, research in other virtual community settings has suggested that the strength of initial motivations may change over time. In particular, initial motivations may not always be strong enough to sustain participation (Fang and Neufeld, 2009). This implies the existence of moderating factors between motivations and participation. Thus, this study focuses on identifying such factors that can moderate the strength of relationships between various motivations and sustained participation behavior in TVC.

To address these two theoretical distinctions, an innovative approach that integrates the social learning process into expectancy-value theory (EVT) is used. Drawing on the EVT (Vroom, 1964), motivational factors, which refer to extrinsic and intrinsic benefits gained through participation in online tasks, are framed as value perceptions to predict participation behavior (Ryan and Deci, 2000a; Ryan and Deci, 2000b). Expectancy perceptions, which reflect the probability to achieve the intended outcome, serve as the moderator between value perceptions and

participation behavior. Solvers are theorized to renew their expectancy perceptions of the complexity of the task (e.g., task complexity) and their ability to complete it (e.g., self-efficacy) in the continued participation stage through social learning process (Weiner, 1992). In this paper, it is argued that this perception reconstruction process may alter the explanatory mechanisms through which motivational factors influence participation behavior. An empirical analysis through a survey over 200 TVC solvers provides general support to the research model.

This study contributes to the theoretical understanding of sustained participation in TVC in several important ways. First, existing findings on the role of intrinsic versus extrinsic motivations in affecting knowledge sharing in RVC are extended to the context of TVC by identifying important distinctions between the two types of communities. These distinctions provide insights into the differential effect of these motivations on knowledge sharing in the TVC context. Second, integrating EVT and the notion of social learning, this study contributes to motivation literature by theorizing and empirically verifying the moderating role of expectancy perceptions on the relationship between motivations and sustained participation behavior.

The rest of the paper proceeds as follows. First, a review of prior literature on knowledge sharing in VCs is performed, with particular attention to the distinctions between prior virtual communities and TVCs, as well as distinctions between initial participation and sustained participation. Subsequently, a research model and hypotheses are developed. The field survey is described in a specific TVC in China used to examine the hypotheses, after which the results are reported. Finally, key findings and limitations of the study, as well as implications for theory and practice, are discussed.

Theoretical Background

Knowledge Sharing in Virtual Communities

Table 1. Motives to Share Knowledge in Virtual Communities		
Motives		Related literature
Personal motives	Extrinsic benefit	(Chiu et al., 2006; Daugherty et al., 2005; Dholakia et al., 2004; Hsu et al., 2007; Wasko and Faraj, 2000)
	Reputation	(Daugherty et al., 2005; Dholakia et al., 2004; Hsu et al., 2007; Lakhani and Hippel, 2003; Wasko and Faraj, 2005)
	Sense of self worth	(Daugherty et al., 2005; Dholakia et al., 2004; Hsu et al., 2007; Lakhani and Hippel, 2003; Wasko and Faraj, 2000)
	Learning	(Daugherty et al., 2005; Hall and Graham, 2004; Wasko and Faraj, 2000)
	Enjoyment in helping others	(Wasko and Faraj, 2000; Wasko and Faraj, 2005)
Social motives	Community advancement	(Chiu et al., 2006; Hsu et al., 2007; Wasko and Faraj, 2000)
	Social identity	(Blanchard, 2008; Dholakia et al., 2004; Ma and Agarwal, 2007)
	Reciprocity	(Chiu et al., 2006; Hall and Graham, 2004; Lakhani and Hippel, 2003; Lin et al., 2009; Wasko and Faraj, 2000; Wasko and Faraj, 2005)
	Sense of belonging	(Blanchard, 2008; Chiu et al., 2006; Daugherty et al., 2005; Lakhani and Hippel, 2003; Lin, 2007b; Lin, 2008; Ma and Agarwal, 2007; Teo et al., 2003; Wasko and Faraj, 2005)

Virtual community is defined by Porter (2004) as “an aggregation of individuals or business partners who interact around a shared interest, where the interaction is at least supported and/or mediated by technology and guided by some protocols or norms.” Virtual communities have long been understood, as well as practiced, as an Internet-based space for socialization (Rheingold, 1993), where “social aggregations ... emerge from the Net when enough people carry on those public discussion long enough, with sufficient human feeling, to form webs of personal relationships in cyberspace” (Rheingold, 1993). As virtual communities of this type exist to facilitate exchange and interactions that bring value to members and form relationships with other members, they are termed relational

virtual communities (RVCs), where knowledge sharing activities are driven by social norm (e.g., reciprocity), and knowledge is treated as a public good that is free to all members (Wasko and Faraj, 2000).

Majority of prior studies on knowledge sharing in virtual communities have focused on the motives of *initial participation in relational virtual communities*. As shown in Table 1, the factors associated with participation can be generally classified into two streams: personal motives and social motives. Personal motives include extrinsic benefit, reputation, sense of self-worth, learning, and enjoyment in helping others, whereas social motives include community advancement, social identity, reciprocity, and sense of belonging. These studies offer a good understanding of why people tend to share their knowledge in the RVC context. However, they may not be adequate to address the following two issues in relation to the objective of the present study, specifically (1) whether these factors, which are important in the RVC context, remain applicable in the TVC context, and (2) whether these factors, relevant to initial participation, are adequate to explain sustained participation. Next, distinctions between RVCs and TVCs and between initial participation and sustained participation are discussed, and the EVT is proposed as the theoretical underpinning of the study.

It is worth noting that knowledge sharing behavior, task participation behavior, and TVC usage behavior are considered the same in this research context. When solvers utilize the TVC, they mainly attempt to participate in online tasks and leverage their knowledge to help others solve problems and gain rewards. Although IS (e.g., TVC in this study) usage behavior continues to rely on technical features such as perceived usefulness and perceived ease of use, focus is directed on the behavioral aspect. Therefore, this study attempts to advance current understanding on continued knowledge sharing behavior and adopt literature on technology acceptance to help explain this issue.

Transactional Virtual Community versus Relational Virtual Community

Recently, researchers have transcended the social view of virtual communities by conceptualizing virtual communities as a business model (Hagel and Armstrong, 1997; Lechner and Hummel, 2002), on the premise that information and knowledge shared by solvers can create actual economic value (Lechner and Hummel, 2002). Growth and prosperity of TVCs have been stimulated by this emerging awareness of the economic value of information or knowledge in virtual communities. Examples of emerging TVCs are Amazon's Mechanical Turk in USA and Taskcn.com in China. In TVCs, knowledge can be priced and exchanged in a transactional way. Particularly, knowledge exchange in TVCs is managed through a competition-based reward system, indicating that a significant number of solvers participate in an online task, and the one who best completes the task can gain the rewards.

Several distinctions exist between TVC and RVC. First, in RVC, knowledge is viewed as a public good defined by its non-excludability (i.e., inability to exclude non-contributors from consumption of public good) and non-rivalry (i.e., good is not expended or depleted in its consumption) (Olson, 1967; Von Hippel and Von Krogh, 2003; Wasko and Faraj, 2000; Wasko et al., 2009). Meanwhile, TVC regards knowledge as a private good whose property is transferred from knowledge providers who seek monetary rewards to knowledge seekers who provide the recompense through the knowledge exchange process.

Second, the underlying mechanisms of solvers' knowledge sharing behavior are different across these two types of VCs as well. Viewing knowledge as a public good, solvers in RVCs treat knowledge exchange as a social activity that relies on the relational contract (Rousseau and McLean Parks, 1993), such as reciprocity and norms (Chiu et al., 2006; Wasko and Faraj, 2000). In contrast, solvers in TVCs tend to regard knowledge exchange as a commercial activity that depends on the transactional contract (Rousseau and McLean Parks, 1993), such as economic benefits and costs. Correspondingly, economic exchange rather than social exchange becomes the principle for knowledge exchange activities in TVCs (Rousseau and McLean Parks, 1993).

These distinctions between the RVC and TVC contexts have important implications to the present study. First, as economic exchange is the principle for knowledge exchange in TVCs, solvers base their decision-making on personal benefits rather than social benefits. Unlike RVCs where community members participate in knowledge exchange activities both to contribute their own knowledge and to acquire needed knowledge from others, knowledge exchange in TVCs is managed through an economic contract. In this situation, social motives such as reciprocity undertaking the role of relational or psychological contract (Rousseau and McLean Parks, 1993) become less relevant in the TVC context.

Second, extrinsic motivation such as monetary rewards should assume a more important role in TVCs than in RVCs. Prior studies on knowledge sharing in RVCs have revealed mixed results on the relationship between extrinsic

motivation and knowledge contribution behavior, including positive effect (Hsu et al., 2007; Kankanhalli et al., 2005), no effect (Bock et al., 2005; Chiu et al., 2006; Lin, 2007a), and negative effect (Bock and Kim, 2002). One possible explanation for the insignificant effect of extrinsic motivation may depend on the social exchange nature of knowledge exchange in these contexts (Wasko and Faraj, 2000). Bock and Kim (2002) described this as an organizational citizenship behavior (OCB) that can be undermined by reward systems (Kats and Kahn, 1966). In other words, when social exchange or gift economics (Wasko and Faraj, 2000) dominate people's knowledge sharing behavior, extrinsic motivation may be not a salient predictor. However, in the TVC context where economic exchange is the norm, the role of extrinsic motivation should be important. The present study is positioned to examine the importance of extrinsic motivation versus intrinsic motivation in TVC.

Initial Participation versus Sustained Participation

Sustainability of virtual communities is an important criterion for measuring the success of VCs (Koh et al., 2007; Teo et al., 2003). From a relationship marketing perspective, a sound virtual community should preserve its membership base and sustain participation (Fang and Neufeld, 2009; Roberts et al., 2006). However, users may initially participate in a virtual community and later leave without intending to return. While sustained participation may be explained using existing motivational factors that predict voluntary initial participation, important differences between initial participation and sustained participation must be considered. Different from initial solvers, sustained solvers have accumulated certain participation experience from which they can attain feedbacks and adjust their subsequent expectations through a social learning process (Bandura, 1977). This social learning process may result in motivational factors that work in the initial participation yet lose their power in sustained participation.

The two aforementioned important distinctions require a theoretical lens that can explain sustained participation in TVCs by accounting for the role of motivational factors, expectancy perceptions, and the social learning process. To achieve such, the EVT and social learning theory are integrated, and this is discussed in the next section.

Expectancy-Value Theory

As a theory widely employed to examine motivational issues (Rasch and Tosi, 1992), EVT suggests that a person's actions are related to his/her *subjective value* of behavioral outcomes and the *expectancy or probability* to conduct the behavior successfully and achieve outcomes (Vroom, 1964). It has become the foundation of a series of behavioral theories, including the theory of reasoned action (Fishbein and Ajzen, 1975) and the uses and gratifications theory (Palmgreen, 1984).

EVT suggests that the effect of motivations on participation behavior is contingent upon expectancy perceptions. Influence of motivational factors on behavioral intentions may not be supported at all times but can be well exerted in select conditions. According to EVT, as expectancy (or value) increases, effect of value (or expectancy) on behavioral intentions increases as well (Shah and Higgins, 1997). Specifically, when people perceive that expectancy to complete a task successfully to be high, their value perception will strongly influence participation intentions. In contrast, if expectancy is extremely low, regardless of how high or low their value perceptions are, people may not participate in the task, indicating a weak relationship between value and intentions.

Expectancy-relevant factors may both directly influence sustained behavior and moderate the relationships between motivational factors and sustained behavior (Schmidt, 1973; Vroom, 1964). Greater emphasis is placed on the moderating effect, as it is more helpful for understanding why people equally motivated to participate in online tasks may diverge in their degree of sustained participation. Prior studies likewise propose the main effects of expectancy and value on behavioral intention (Shah and Higgins, 1997). These main effects are controlled in the analysis, but particular attention is placed on interaction effects in this study.

Reformulation of Expectancy through Social Learning Process

The original form of EVT is a static model that considers how expectancy and value perceptions influence behavioral intentions at a single point in time (Vroom, 1964). However, in a longitudinal view, people's beliefs may not remain stable at all times but rather evolve through a social learning process. By drawing upon social learning process, recent development of EVT makes a paradigm shift from a static model to a dynamic model. The modern EVT explains how expectancy perceptions are renewed through feedbacks from past behavior (Eccles and Wigfield,

2002). For example, gratification theory argues that prior behavior and gratifications can reshape people's expectancy perceptions (Palmgreen, 1984), and the goal-setting theory suggests that people adjust their perceptions on self-efficacy and task complexity according to their prior performance and satisfaction level (Locke and Latham, 2002).

The notion of renewed expectancy perceptions is beneficial for understanding the distinction between initial participation and sustained participation discussed earlier in this paper. According to the modern EVT, initial participation is determined by initial expectancy and value perceptions, and sustained participation is determined by adjusted expectancy and value perceptions. While value perceptions are considered as being renewed through the social learning process in certain models (Eccles and Wigfield, 2002), this paper submits that these evolutions may be highly limited. As values are a set of stable, general perceptions on what is desirable and emerge from both society's norms and the individual's psychological needs (Rokeach, 1979), they are not easily changed through social learning process. This is consistent with the assumption that underlies the uses and gratification theory (Palmgreen, 1984) and goal-setting theory (Locke and Latham, 2002). Thus, expectancy perceptions are considered to be evolving yet value perceptions are deemed stable. As value perceptions remain stable (i.e., initial value is equal to adjusted value), the reason why people initially participate in online tasks yet fail to retain sustained participation can be attributed to the evolution of expectancy perceptions. In particular, those who initially consider expectancy to be high but subsequently consider it as low will not engage in continued participation in online tasks.

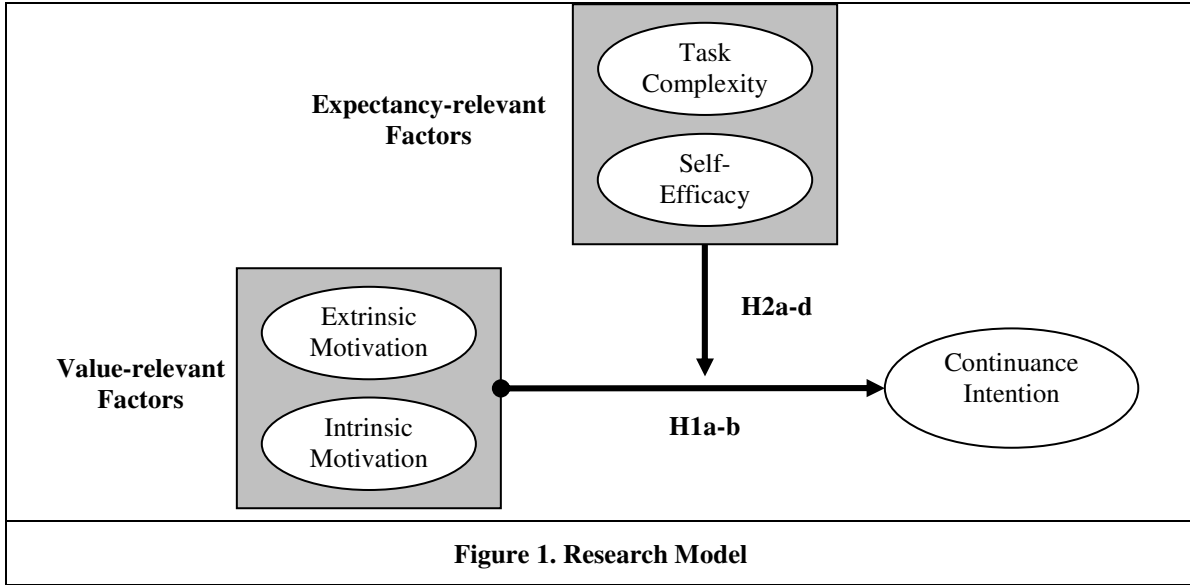
Research Model and Hypotheses

The research model is founded on the integration of EVT and social learning process (Figure 1). Two value-relevant factors and two expectancy-relevant factors are proposed to have main effects on sustained participation, which is measured by continuance intention. Furthermore, expectancy-relevant factors are proposed to moderate the relationships between value-relevant factors and continuance intentions¹.

Extrinsic and intrinsic motivations are used to address value-relevant factors. Value is regarded as a key concept in motivation theories; specifically, people are motivated to perform a particular behavior because they intend to attain certain value to satisfy innate needs (Ryan and Deci, 2000a; Ryan and Deci, 2000b). Value can be produced by outcomes (i.e., instrumental value) or process (i.e., experiential value), and these two values respectively correspond to extrinsic and intrinsic motivations in terms of the self determination theory or SDT (Ryan and Deci, 2000a; Ryan and Deci, 2000b). Specifically, focus is placed on monetary rewards (e.g., extrinsic motivation) and sense of self-worth or achievement (e.g., intrinsic motivation) to capture value perceptions.

Self-efficacy and task complexity are viewed as two expectancy-relevant factors. Task complexity refers to the perception on the extent to which a task is difficult to complete, and self-efficacy refers to the perception on a person's ability and competence to accomplish tasks. People can attribute their successes or failures to internal factors such as self-efficacy and external factors such as task complexity (Weiner, 1992). After initial participation in online tasks, solvers will renew their perceptions of self-efficacy and task complexity by assessing their previous performance (Bandura, 1977). For example, when solvers achieve low performance in previous participation, they may lower their perceptions on self-efficacy or raise their perceptions on task complexity. It is worth noting that self-efficacy and task complexity are not initial perceptions but perceptions formed based on prior experience. These adjusted perceptions based on first-hand experience, rather than initial perceptions based on imagination, may prove to be more accurate in capturing solvers' perceptions of their ability and task complexity, and to be more relevant to sustained participation.

¹ It is worth noting that the expectancy-value theory may be applicable to the general adoption behavior rather than merely continued adoption behavior. This study attempts to leverage this theory to capture the reasons why solvers initially participate in online tasks but later on abandon the community. To explain this issue, solvers are observed to adjust their perceptions of task complexity and self-efficacy through a social learning process. Motivational factors are stable across time and remain constant in both initial and sustained participation. Therefore, the present model in a certain sense describes how solver behavior evolves along with time rather than at a fixed time point. However, as pointed out in the limitation part, conducting a longitudinal study is a better way to explain this phenomenon. This should be considered in future research.



Extrinsic and Intrinsic Motivation

Motivation theories such as self-determination theory (Deci and Ryan, 1985; Ryan and Deci, 2000a; Ryan and Deci, 2000b) have distinguished between different types of motivation based on the different reasons or goals that drive individuals to conduct an action. Extrinsic motivation and intrinsic motivation are considered as the most basic classification of motivation; however, while the former refers to performing an act because it leads to a separable outcome, the latter pertains to performing an act because it is inherently interesting or enjoyable (Ryan and Deci, 2000a). In the present research context, extrinsic motivation mainly refers to monetary rewards provided by seekers as compensation for solvers’ time and effort expended on online tasks, whereas intrinsic motivation refers to the enjoyment and sense of self-worth caused by participating in online tasks.

Viewing knowledge as a private good, solvers in TVCs tend to exchange knowledge through market mechanisms to receive commensurate benefits (Von Hippel and Von Krogh, 2003). Therefore, extrinsic rewards should play a more important role in the knowledge sharing process in TVCs than in RVCs where social exchange is the norm (Wasko and Faraj, 2000). When solvers formulate decision on whether or not to continue participating in online tasks, they evaluate the value of behavioral outcomes caused by the task participation activity (Vroom, 1964). Extrinsic rewards, as a key source of solvers’ value perceptions, should have a positive influence on solvers’ continuance intentions. Thus, the following hypothesis is proposed:

H1a: Extrinsic motivation is positively associated with continuance intention.

Intrinsic motivation is considered a determinant of solvers’ continuance intentions. According to the self-determination theory, individual behavior will be evoked when people consider that the behavior can satisfy their needs for competence (Roberts et al., 2006; Ryan and Deci, 2000b). Prior studies in the RVC context have revealed that people will engage in knowledge contribution when they experience a sense of self-worth and achievement (Bock et al., 2005; Kankanhalli et al., 2005; Lin, 2007a). Since tasks in TVCs are more complex compared with those in RVCs (Yang et al., 2008), participating in these tasks can more likely allow solvers to face a challenge that can satisfy their need for competence (Locke and Latham, 2002). Furthermore, TVC is managed through a competition-based reward system, and solvers can attain a sense of achievement when they compete with peers and win the competition. Thus, intrinsic motivation has a positive influence on continuance intention as well. Thus, the following hypothesis is proposed:

H1b: Intrinsic motivation is positively associated with continuance intention.

Moderating Effects of Task Complexity and Self-efficacy

Task complexity is defined as solvers' perceptions on the extent to which online tasks in TVCs are difficult to complete. Self-efficacy, meanwhile, pertains to their perceptions on the extent to which they possess the competence to accomplish online tasks in TVCs. Since the task fulfillment process is an individual-task interaction process, the probability to succeed in tasks should be associated with both individuals and tasks. This paper argues that the probability to succeed in a task is determined by the comparison between an individual's ability and the ability required by the task. Particularly, when the individual's ability exceeds the required ability, the individual is more likely to succeed; in contrast, when the individual's ability is lower than the required ability, the probability of success will be low as well. Therefore, expectancy is positively associated with self-efficacy but negatively associated with task complexity.

According to the EVT, a positive interaction effect exists between expectancy and value (Shah and Higgins, 1997; Vroom, 1964). This implies that extrinsic motivation only can exert its influence on participation intention when solvers consider the probability of success to be high. When probability to win is low, even if extrinsic rewards are high, solvers may still not participate in the task. In contrast, when the probability to win is high, even low extrinsic rewards may lead to high participation intention. Therefore, the probability to succeed positively moderates the relationship between extrinsic motivation and continuance intention. This likewise explains why people who initially participate in online tasks diverge in their sustained participation behavior; those who perceive high probability to succeed will stay while those who believe the probability to be low will leave. Inasmuch as task complexity is negatively associated with the probability to succeed, while self-efficacy is positively associated with the probability to succeed, this paper proposes that task complexity should weaken the relationship between extrinsic motivation and continuance intention, whereas self-efficacy should strengthen this relationship. Thus, the following are hypothesized:

H2a: Task complexity negatively moderates the relationship between extrinsic motivation and continuance intention.

H2b: Self-efficacy positively moderates the relationship between extrinsic motivation and continuance intention.

Intrinsic motivation can influence participation intention depending on fulfilling two conditions: (1) the extent to which task accomplishment can demonstrate solvers' competence, and (2) the probability that solvers can succeed in the task. With respect to the first condition, if a solver can successfully complete a task, yet task fulfillment cannot indicate if the solver is competent, participating in this task cannot satisfy his/her needs for competence. For example, a simple task can be easily completed but participating in it may not provide a sense of achievement. As to the second condition, a sense of achievement can be attained only when solvers succeed in the task. If a person participates in a task that is far beyond her/his ability, it is impossible for her/him to accomplish the task, and the intrinsic motivation may not be satisfied either. In other words, when these two conditions are not available, intrinsic motivation may not be able to explain the cause of participation behavior, because participating in these tasks, in fact, fail to satisfy the need for competence.

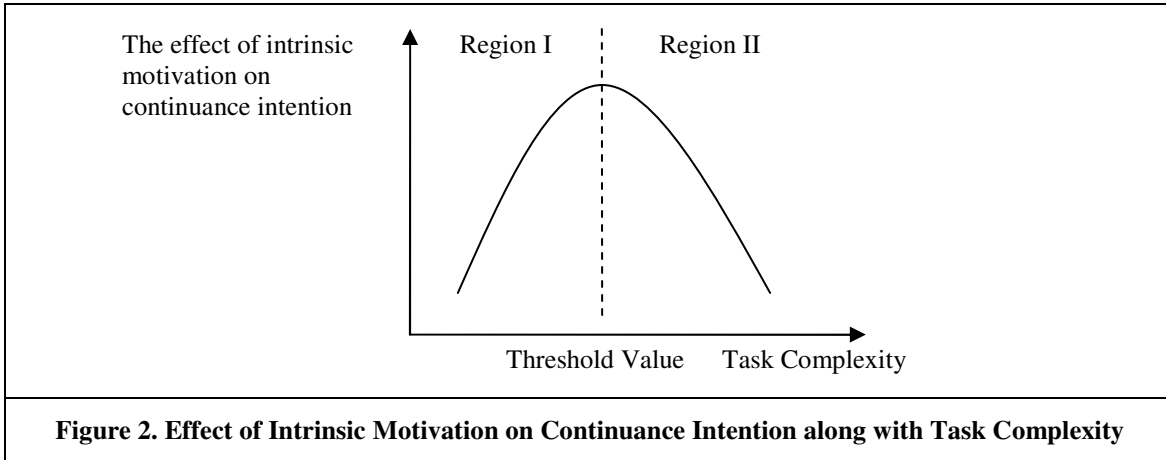
Task complexity is associated with both of these two conditions, but in competing ways. On the one hand, task complexity indicates the extent of challenge (Campbell, 1988) connected with human innate needs for competence (Deci and Ryan, 1985). When a task is more complex, completing the task can represent a higher competence; it is more likely to satisfy people's needs for competence. On the other hand, task complexity is negatively related with the probability to complete tasks. In this case, when a task becomes more complex, people are faced with greater difficulty to complete the task and achieve a sense of competence. To summarize, when a task is too simple, completing it cannot bring a sense of competence among people; when a task is too difficult, people might not complete the task and would not gain a sense of competence as well. Under both situations, intrinsic motivation has a weak influence on participation behavior. Only when a moderate level of task complexity is perceived can intrinsic motivation strongly affect participation behavior. Thus, this paper argues that the effect of task complexity on the relationship between intrinsic motivation and participation behavior exhibits an inverted-U shape, as illustrated in Figure 2. The following hypothesis is proposed:

H2c: The effect of intrinsic motivation on continuance intention is weak at low levels of perceived task complexity; it reaches a peak substantive positive effect at moderate levels of perceived task complexity and it is again weak at high levels of perceived task complexity.

Self-efficacy is likewise relevant to the solvers' sense of competence and the probability that they can succeed in tasks. When self-efficacy is high, a solver perceives himself/herself as highly competent and possessing a high

probability to complete tasks successfully. Thus, intrinsic motivation should produce a stronger influence on participation when self-efficacy is high. When self-efficacy is low, the solver would feel less competent and experience difficulty in accomplishing the task, hence leading to a weak influence of intrinsic motivation on participation. In other words, self-efficacy is argued to moderate the relationship between intrinsic motivation and continuance intention positively. Thus, the following is hypothesized:

H2d: Self-efficacy positively moderates the relationship between intrinsic motivation and continuance intention.



Methodology

Setting and Participants

Data were collected through a field survey in a specific TVC website, Taskcn.com, in China (Witkey website in their term). Although various types of tasks such as design, programming, strategic planning, and writing are posted on Taskcn.com, focus is placed on IT-relevant tasks; specifically, the final product should be an IT artifact (e.g., a website, program, or computer-aided logo design). IT-relevant tasks are more knowledge-intensive, requiring solvers to invest a host of resources such as knowledge, time, and effort in the task fulfillment process. This is consistent with the present research objective of understanding knowledge exchange behavior in TVCs. Several other tasks, such as naming a baby, require minimal knowledge, and are not suitable for this study. Thus, only solvers with experience in IT-related tasks in the research site are eligible for participation in the survey.

Subjects were recruited by means of two channels. First, the survey was undertaken as an online task and posted on the Taskcn.com website. In the task description, the objective of the study and requirements of participants were introduced. Solvers with experience in IT design tasks (e.g., logo design, graphic design, website design, and program design) were eligible to participate in the survey. The URL of the questionnaire Web page was shown in the description as well. A lucky draw with a success rate of 10% was to be conducted, and each winner could gain RMB 20 (approximately US\$ 3). The second channel for collecting data was through deployment of e-mails to solvers with experience in IT design tasks. In the e-mail, solvers were informed of the objective of the study, URL of the survey task Web page on Taskcn.com, and the questionnaire Web page. In this study, 700 in-site e-mails were sent to target solvers. An e-mail reminder was sent two weeks later to those who had not filled the questionnaire. Then, 507 subjects were gathered; the other 193 subjects had not once checked their in-site e-mail box during the survey period. As solvers could only receive in-site e-mail after logging on to the website, these 193 subjects were removed from the sample due to delivery failure.

Next, 140 and 146 responses were obtained through the two channels, respectively. Among the responses gathered through the first channel, three were incomplete, three were repeated, and 75 subjects had never participated in any IT design project prior to the project. Thus, only 59 usable responses were obtained from the first channel. Assessment of response rate through the first channel was difficult as the number of people who viewed the task was unknown. With regard to the second channel, a response rate of $146/507=28.8\%$ was generated. Overall, 205 usable responses were gathered.

Table 2. Demographics					
		Overall Sample*	Channel I	Channel II	Chi-Square Test**
Gender					0.048 (.827)
	Male	155 (75.6%)	44 (74.6%)	111 (76.0%)	
	Female	50 (24.4%)	15 (25.4%)	35 (24.0%)	
Age					7.937 (.160)
	<=20	10 (4.9%)	4 (6.8%)	6 (4.1%)	
	21-25	116 (56.6%)	40 (67.8%)	76 (52.1%)	
	26-35	70 (34.1%)	15 (25.4%)	55 (37.7%)	
	36-45	7 (3.4%)	0 (0)	7 (4.8%)	
	46-55	1 (0.5%)	0 (0)	1 (0.7%)	
	>55	1 (0.5%)	0 (0)	1 (0.7%)	
Education					5.613 (.132)
	< high school	2 (1.0%)	0 (0)	2 (1.4%)	
	High school	35 (17.1%)	8 (13.6%)	27 (18.5%)	
	Bachelor	162 (79.0%)	47 (79.6%)	115 (78.7%)	
	Master or Higher	6 (2.9%)	4 (6.8%)	2 (1.4%)	
Computer Experience					3.819 (.282)
	<2 years	6 (2.9%)	1 (1.7%)	5 (3.4%)	
	2-4 years	56 (27.3%)	21 (35.6%)	35 (24.0%)	
	4-8 years	84 (41.0%)	24 (40.7%)	60 (41.1%)	
	>8 years	59 (28.8%)	13 (22.0%)	46 (31.5%)	
Internet Experience					3.373 (.338)
	<2 years	10 (4.9%)	4 (6.8%)	6 (4.1%)	
	2-4 years	60 (29.3%)	20 (33.9%)	40 (27.4%)	
	4-8 years	88 (42.9%)	26 (44.1%)	62 (42.5%)	
	>8 years	47 (22.9%)	9 (15.3%)	38 (26.0%)	
Witkey Experience					7.453 (.114)
	< 3 months	55 (26.8%)	18 (30.5%)	37 (25.3)	
	3-6 months	51 (24.9%)	14 (23.7%)	37 (25.3%)	
	6-12 months	47 (22.9%)	8 (13.6%)	39 (26.7%)	
	1-2 years	41 (20.0%)	17 (28.8%)	24 (16.4%)	
	>2 years	11 (5.4%)	2 (3.4%)	9 (6.2%)	

* The number outside the parentheses describes frequency, while the number within the parentheses indicates ratio.

** The number outside the parentheses pertains to the Chi-square value, while the number within the parentheses refers to significance (p-value).

The demographics of the respondents are presented in Table 2. To ensure the appropriateness of merging the two datasets, demographics of respondents from the two data collection channels were compared as well. According to the comparison, no significant differences existed in gender ($\chi^2=0.048$, $p=0.827$), age ($\chi^2=7.937$, $p=0.160$), education ($\chi^2=5.613$, $p=0.132$), experience in computer ($\chi^2=3.819$, $p=0.282$), experience in the Internet ($\chi^2=3.373$, $p=0.338$), and experience in Witkey ($\chi^2=7.453$, $p=0.114$). Therefore, overall sample was employed in later analysis.

Instruments

Instruments for majority of constructs were adopted from prior relevant studies (Appendix A). Slight wording modifications were applied to suit the research context, and all measures used a seven-point Likert scale. Sustained participation was measured using the instrument of continuance intention adopted from Bhattacharjee (2001). According to the theory of reasoned action, intention is a salient predictor of behavior (Fishbein and Ajzen, 1975), thus the continuance intention was used as the proxy of sustained participation behavior. Meanwhile, extrinsic motivation was measured by extrinsic rewards adopted from Kankanhalli et al. (2005). Intrinsic motivation was measured by two items describing perceived enjoyment (Ke and Zhang, 2009) and two items describing the sense of achievement (Roberts et al., 2006). Task complexity was measured by three items such as perceived difficulty to complete tasks (Yeo and Neal, 2004), perceived challenge of online tasks (Taylor, 1981), and belief on the complexity of online tasks (Seijts et al., 2004). Three items used to measure self-efficacy were adopted from Kankanhalli et al. (2005).

Data Analysis

Data analysis was conducted through two stages. At the first stage, the reliability and validity of constructs were assessed to ensure the appropriateness of the measurement model. At the second stage, the hypotheses were tested using moderated multiple regression analysis (Kankanhalli et al., 2005). The measurement model was tested using LISREL software instead of PLS software because as a covariance-based structural equation modeling (SEM) tool, the former is more suitable for conducting confirmatory analysis and stricter than the latter. Moderated multiple regression (MMR) analysis was used to test the hypotheses because it is a mature analysis approach widely utilized in organization science, appearing on esteemed publications such as *Journal of Applied Psychology* and *Academy of Management Journal* (Aguinis and Gottfredson, 2010). It is more proper to deal with the model with multiple interaction effects. In contrast, the techniques to test interaction effect using LISREL are controversial (Algina and Moulder, 2001) and call for a relatively larger sample size. In this case, LISREL was used to test the measurement model and MMR was adopted to test the hypotheses.

Reliability and Validity

Reliability and convergent validity for constructs were assessed using confirmatory factor analysis (CFA) in LISREL 8.70 software. CFA results revealed that loadings for the second item of continuance intention (CI2) and third item of extrinsic motivation (EXM3) were lower than 0.5; thus, these two items were excluded from the model and not considered in later analysis (Kettinger and Lee, 1994). After removing these two items, all constructs in the model were with sound reliability and convergent validity (Table 3).

Reliability, which refers to consistency of measurement, can be examined by composite reliability (CR) and average variance extracted (AVE) (Fornell and Larcker, 1981). Results in Table 3 reveal that the CR and AVE for all constructs exceed the threshold values of 0.60 and 0.50, respectively (Fornell and Larcker, 1981; Hsu and Lin, 2008), exhibiting sound construct reliability. If all factor loadings for indicators measuring the same construct are statistically significant, the convergent validity of those indicators was supported (Anderson and Gerbing, 1988; Jiang et al., 2002). All t-tests were significant, signifying that all indicators possessed high convergent validity.

Discriminant validity can be assessed by comparing the square root of a construct's AVE and the correlations relevant to this construct (Fornell and Larcker, 1981). If the square root of AVE is greater than all correlations relevant to the construct, discriminant validity is achieved. Table 4 shows that the square root of AVE is greater than correlations for all constructs, indicating sound discriminant validity.

Fitness measures for the measurement model included $\chi^2/d.f.$, goodness of fit index (GFI), adjusted GFI (AGFI), normed fit index (NFI), non-normed fit index (NNFI), comparative fit index (CFI), and root mean square error of approximation (RMSEA). These were used to test the goodness of fit of the measurement model. The following

were obtained: $\chi^2/d.f.=2.67$, GFI=.89, AGFI=.83, NFI=.91, NNFI=.92, CFI=.94, and RMSEA=.089. All fell within acceptable ranges (Bentler and Bonett, 1980). Therefore, the measurement model provided a suitable fit.

Constructs	CR	AVE	Items	Loadings (λ)	Error Variance (θ)	T-statistics
Continuance Intention (CI)	.84	.72	CI1	.95	.10	13.68
			CI3	.74	.46	10.58
Extrinsic Motivation (EXM)	.67	.50	EXM1	.78	.39	11.12
			EXM2	.63	.60	9.04
Intrinsic Motivation (IXM)	.86	.61	IXM1	.75	.44	11.85
			IXM2	.83	.32	13.69
			IXM3	.81	.35	13.30
			IXM4	.74	.45	11.71
Task Complexity (TSKX)	.76	.52	TSKX1	.88	.23	11.99
			TSKX2	.56	.69	7.68
			TSKX3	.70	.51	9.66
Self-efficacy (SEFC)	.86	.67	SEFC1	.78	.39	12.85
			SEFC2	.76	.43	12.19
			SEFC3	.91	.16	16.12

Note: $CR = \frac{(\sum \lambda)^2}{(\sum \lambda)^2 + \sum (\theta)}$, $AVE = \frac{(\sum \lambda^2)}{(\sum \lambda^2) + \sum (\theta)}$ (Fornell and Larcker 1981)

	Mean	SD	CI	EXM	IXM	TSKX	SEFC
1. Continuance Intention (CI)	5.912	1.109	.849				
2. Extrinsic Motivation (EXM)	5.424	1.264	.365***	.707			
3. Intrinsic Motivation (IXM)	5.639	1.045	.487***	.400***	.781		
4. Task Complexity (TSKX)	4.423	1.279	.231***	.047	.163*	.721	
5. Self-Efficacy (SEFC)	5.540	1.145	.301***	.598***	.432***	-.109	.819

*p<.05, **p<.01, ***p<.001
The numbers in bold in the diagonal row are square roots of the average variance extracted.

Furthermore, as all questions were answered by the same respondents, a threat of common-method bias (CMB) may exist. To justify whether this issue is a problem for this study, a test was conducted using the hierarchically nested covariance structure model in LISREL 8.70 (Cote and Buckley, 1987; Zhou et al., 2007). Analysis revealed that CMB does not pose a major threat to the study (Appendix B).

Hypotheses Tests

Moderated multiple regression is used to test interaction effects in IS research and other disciplines (Kankanhalli et al., 2005). It is conducted in a hierarchical procedure wherein the main effects of independent constructs (IVs) are

tested first and subsequently the relationship between interaction terms (i.e., the product of two independent constructs) and the dependent construct (DV) are tested as well (Kankanhalli et al., 2005; Sharma et al., 1981).

To control the main effects of expectancy-relevant factors in this study, task complexity and self-efficacy were firstly entered in Model I. Then, value-relevant factors – extrinsic and intrinsic motivations – were entered in Model II, and interaction terms between value-relevant constructs and expectancy-relevant constructs were entered in Model III. Average values of items for every construct were used to measure these constructs (Kankanhalli et al., 2005). For each construct, standardized value is employed in the regression to examine interaction effects (Chin et al., 2003). R² values of Model II and Model III were .298 and .393, respectively, indicating a more than satisfactory explanation of the variance in continuance intention (Kankanhalli et al., 2005). Change in R² value between Model II and Model I was .137 (change in F=19.545, p<.001) and that between Model III and Model II was .095 (change in F=7.634, p<.001). These indicate that the main effects of value-relevant factors and moderating effects between expectancy- and value-relevant factors are highly significant.

	Model I	Model II	Model III	Hypothesis Test
Task complexity (TSKX)	.267**	.169**	.197***	
Self-efficacy (SEFC)	.330**	.055	.172*	
Extrinsic motivation (EXM)		.178*	.107	H1a was partially supported
Intrinsic motivation (IXM)		.364***	.340***	H1b was supported
EXM * TSKX			-.312***	H2a was supported
EXM * SEFC			-.135	H2b was not supported
IXM * TSKX			.000	
IXM * SEFC			.274***	H2d was supported
R ²	.161	.298	.393	
R ² change		.137	.095	
F change		19.545***	7.634***	
*p<.05, **p<.01, ***p<.001				

Table 5 summarizes the results of hypotheses tests. Extrinsic motivation had significant effect on continuance intention in Model II ($\beta=.178$, $p<.05$) but not in Model III ($\beta=.107$, $p>.1$), demonstrating that its effect on continuance intention may be moderated by other factors. Intrinsic motivation produced a significant effect on continuance intention in both Model II and Model III (all $p<.01$), lending support to H1b. Furthermore, task complexity was observed to moderate the relationship between extrinsic motivation and continuance intention negatively ($\beta=-.312$, $p<.001$). Meanwhile, self-efficacy was observed to moderate the relationship between intrinsic motivation and continuance intention positively ($\beta=.274$, $p<.001$). These provide support for H2a and H2d. No significant interaction effects between extrinsic motivation and self-efficacy were observed; thus, H2b was not supported.

As illustrated in Figure 3, extrinsic motivation produces a positive and significant influence on continuance intention in the low task complexity conditions ($\beta=.494$, $p<.001$), but also an insignificant effect on continuance intention in the high task complexity condition ($\beta=.119$, $p>.1$). This indicates that the effect of extrinsic motivation on continuance intention is significant only when task complexity is low, thus partially supporting H1a. Further analysis by comparing the beta coefficients in these two conditions revealed that these two coefficients were significantly different ($\Delta=.375$, $t=34.41$), supporting H2a as well. The effects of intrinsic motivation on continuance intention were observed as significant in both the low self-efficacy condition ($\beta=.417$, $p<.001$) and high self-efficacy condition ($\beta=.556$, $p<.001$). These two coefficients were significantly different as well ($\Delta=.139$, $t=10.15$), supporting H2d.

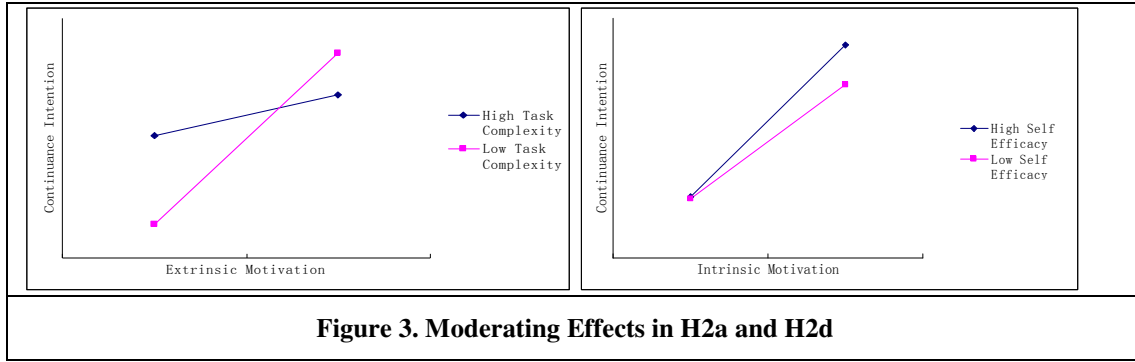


Figure 3. Moderating Effects in H2a and H2d

The inverted U moderating effect (H2c) can be tested by comparing the coefficients between the independent variable and dependent variable under different levels of the moderator (Gefen and Pavlou, 2006). If there is a significant increase in the coefficient when comparing the low and moderate levels as well as a significant decrease in the coefficient when comparing the moderate and high levels, the inverted U moderating effect can be confirmed. As illustrated in Figure 4, the coefficients between intrinsic motivation and continuance intention are significant when task complexity is moderate and low; however, it is not significant when task complexity is high. Using Keil et al.'s (2000) method to compare coefficients, as Gefen and Pavlou (2006) did, the coefficient of intrinsic motivation on continuance intention for the moderate level of task complexity [$\beta = .587$ ($SE = .094$)] is observed as significantly larger ($t = 22.13$) than that for the high task complexity [$\beta = .181$ ($SE = .128$)]. This value is also significantly larger ($t = 2.47$) than that for the low task complexity [$\beta = .543$ ($SE = .123$)]. Overall, this supports H2c.

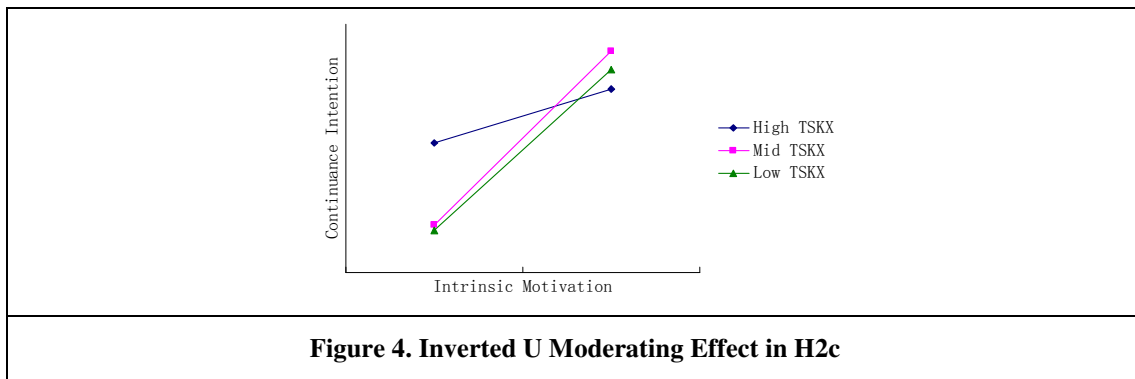


Figure 4. Inverted U Moderating Effect in H2c

Discussions and Implications

Key Findings

A number of interesting findings can be derived from this study. First, extrinsic motivation is not a determinant of continuance intention at all times. Specifically, the relationship between extrinsic motivation and continuance intention is moderated by task complexity. When task complexity is low or moderate, extrinsic motivation has a positive and significant influence on continuance intention. However, when task complexity is exceedingly high, extrinsic motivation has no effect on continuance intention.

Second, intrinsic motivation plays an important role in the TVC context. As a virtual community with competition-based reward system, solvers may enjoy the challenge residing in the task participation process. Experiencing a sense of self-worth is a critical motivator of sustained participation behavior. Particularly, a positive interaction effect between intrinsic motivation and self-efficacy is observed, suggesting that when solvers perceive high self-efficacy, the influence of intrinsic motivation (e.g., sense of self-worth) on continuance intention will be considerably stronger.

Third, relationship between intrinsic motivation and continuance intention is not solely moderated, either positively or negatively, by task complexity. Specifically, the relationship between task complexity and effect of intrinsic

motivation on continuance intention is not linear but inverted-U shaped. When task complexity is exceedingly low or high, the relationship between intrinsic motivation and continuance intention is weak. There is a threshold value of task complexity where the relationship between intrinsic motivation and continuance intention is strongest. Before this threshold value, as task complexity increases, influence of intrinsic motivation on continuance intention increases as well. After obtaining this threshold value, this study found that as task complexity increases, influence of intrinsic motivation on continuance intention decreases.

However, the hypothesized positive interaction effect between extrinsic motivation and self-efficacy is not supported. One possible explanation for this insignificant interaction effect can be attributed to the crowding-out effect between extrinsic and intrinsic motivation (Deci, 1975; Frey and Oberholzer-Gee, 1997). The crowding-out effect of motivation shows that when the effect of one type of motivation increases, the effect of the other type of motivation decreases (Deci, 1975). In this study, the effect of intrinsic motivation increases when self-efficacy increases; however, this will decrease the effect of extrinsic motivation (i.e., crowding-out effect). Thus, an increase in the effect of extrinsic motivation caused by self-efficacy may be neutralized by the crowding-out effect of intrinsic motivation, and no significant increase in the effect of extrinsic motivation may be observed.

Limitations

Before discussing the implications, limitations of this study must first be addressed. First, the study was conducted in a specific TVC website in China. Although similar websites exist in the USA (e.g., Amazon's Mechanical Turk), they are different in terms of task types and reward scale; few IT-relevant tasks are posted on Mechanical Turk and no more than US\$ 10 rewards are provided to solvers. These differences may limit the generalizability of conclusion to other websites. Furthermore, prior studies on culture postulate that individuals with different cultural backgrounds have different behavioral motivations; that is, individualists are more likely motivated by extrinsic and instrumental incentives, while collectivists tend to base their decision making on intrinsic and relational factors (Hofstede, 1980). Therefore, the effects of extrinsic and intrinsic motivations on sustained participation may vary across countries with different cultures. Future studies should focus on the cross-culture issue and compare results in different cultural contexts to extend the proposed research model in this study.

Second, the use of cross-sectional data and regression analysis does not allow the possibility of exploring feedback effects. Expectancy-relevant and value-relevant factors were explored at the same time point when solvers have achieved certain TVC participation experience. This study attempted to use the adjusted expectancy and value perceptions to understand why people diverge in their sustained participation. However, a better understanding of this issue may need to consider both adjusted perceptions and initial perceptions through a longitudinal analysis. These may better capture how people's perceptions evolve across time. Such should be taken into account in future research.

Theoretical Implications

This study advances theoretical development in the area of knowledge sharing in virtual community by filling two research gaps. First, previous studies on knowledge sharing in virtual communities are conducted in the context of RVC, but factors influencing people's knowledge sharing behavior in the TVC is not sufficiently investigated. Second, majority of prior studies accord greater attention to the general motivation or initial motivation to participate in knowledge sharing virtual communities (Chiu et al., 2006; Daugherty et al., 2005; Dholakia et al., 2004; Hsu et al., 2007; Wasko and Faraj, 2000). However, the underlying mechanism that could explain the sustained participation behavior is not fully understood. This study developed a research model to address these two gaps based on the EVT and social learning theory.

First, this study extends previous understanding on knowledge sharing in RVC to the context of TVC by identifying distinctions between these two research contexts and discovering how the underlying motivation mechanisms explaining knowledge sharing behavior change due to these distinctions. Two key distinctions between RVC and TVC are identified: (1) knowledge is considered as a public good in RVCs but a private good in TVCs, and (2) knowledge sharing follows a principle of social exchange in RVCs but a principle of economic exchange in TVC. Because of these distinctions, the underlying mechanisms explaining people's knowledge sharing behavior are different. In RVCs, extrinsic rewards or self benefits are not the major incentives that motivate people to share their knowledge (Bock et al., 2005; Chiu et al., 2006; Hsu et al., 2007), and only intrinsic motivation plays a highly important role in this context (Wasko and Faraj, 2000). The present study finds that the TVC context is a different

story. As economic rewards are provided by TVCs and economic exchange becomes the principle of knowledge sharing, the role of extrinsic motivation is more salient in this context. However, intrinsic motivation (e.g., sense of self-worth) remains an important predictor of knowledge sharing behavior. These conclusions enrich the understanding of knowledge sharing in virtual communities, further implying that economic factors should be considered when investigating TVCs.

Second, this study contributes to the theoretical understanding of sustained participation in TVC. In particular, drawing on EVT and the notion of social learning, this study offers insights into why a number of solvers motivated to participate in online tasks no longer continue their participation in the community. This is achieved by theoretically identifying and empirically examining the boundary conditions of the effects of extrinsic and intrinsic motivation (i.e., explaining when extrinsic and intrinsic motivation do or do not predict sustained participation in TVC by identifying renewed expectancy perceptions as important moderating factors). Specifically, the results reconcile mixed findings on the behavioral impact of extrinsic motivation by showing that extrinsic motivation strongly influences continued knowledge sharing in TVC only when task complexity is low. Equally important, results add to the existing theory on the behavioral impact of intrinsic motivation by identifying self-efficacy as a moderator. Furthermore, this study contributes to the current understanding of the effect of intrinsic motivation on participation behavior by theorizing and empirically examining an inverted U moderating effect of task complexity. The results question the simple linear effect of task complexity, stressing that the effect of intrinsic motivation on continuance intention is strongest only for the moderate level of task complexity, compared with the low and high levels.

Practical Implications

This study likewise provides important insights and practical strategies to practitioners who manage TVCs. First, Web sponsors should pay heed to the distinction between initial participation and sustained participation. Results reveal that initial motivations may not be adequate to predict sustained participation, and the determinants of sustained participation differ from those of initial participation. This implies that, in practice, Web sponsors should not only develop strategies to motivate participants, but manage as well the participants' ongoing expectations on their ability to and probability of accomplishing given tasks. Second, the study suggests ways of setting the complexity of online tasks. Specifically, extrinsic rewards for task completion should be designed by considering the complexity of the task. Similarly, this study suggests that to best leverage the solvers' intrinsic motivation, tasks should be characterized by moderate complexity. Third, the study likewise suggests that Web sponsors should implement various strategies to enhance the solvers' self-efficacy. The current practice in TVCs adopts the "winner-take-all" mechanism. In particular, only winners can obtain rewards while the rest receive no recompense. However, this mechanism may discourage solvers who are competent in completing the task but are not the best. This may force them to perceive low self-efficacy and quit from TVCs. A better mechanism should consider not only the winner but the one who effectively accomplishes tasks as well. For example, in addition to the winner, several other solvers who completed the task exceptionally can be listed as finalists with proper recognition.

Conclusion

Initial motivations to participate in TVCs may fail to explain sustained participation. To address this research gap, a theoretical model explaining how the influence of motivational factors on participation is contingent on social learning factors is developed and tested. Task complexity and self-efficacy, which are associated with the social learning process, are considered to moderate the relationship between motivational factors and continuance intention. The confirmed interaction effects indicate that the effects of motivational factors on continuance intention are contingent on the level of task complexity and self-efficacy. This study contributes to theory building by adopting two moderators to capture the distinctions between initial participation and sustained participation. It contributes to practice by providing suggestions on the mechanism design to post tasks appropriately and enhance solvers' self-efficacy.

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Appendix A

Continuance Intention (CI): Adapted from Bhattacharjee (2001)

CI1: I intend to continue participating in the tasks on the Taskcn.com.

CI2: My intentions are to continue participating in the tasks on the Taskcn.com rather than on other websites.*

CI3: If I could, I would like to continue my participation in the tasks on the Taskcn.com.

Extrinsic Motivation (EXM): Adapted from Kankanhalli et al. (2005)

EXM1: I will receive some monetary rewards in return for participating in online tasks.

EXM2: Participating in online tasks can help me earn some money.

EXM3: Seekers provide some monetary rewards to task solvers.*

Intrinsic Motivation (IXM): Adapted from Ke et al. (2009) and Roberts et al. (2006)

IXM1: Participating in the tasks on the Taskcn.com is very interesting.

IXM2: The process of participating in the tasks on the Taskcn.com is very pleasant.

IXM3: Participating in the tasks on the Taskcn.com lets me feel a sense of personal achievement.

IXM4: Taskcn.com gives me a chance to do things I am good at.

Task Complexity (TSKX): Adapted from Yeo et al. (2004), Taylor (1981), and Seijts et al. (2004)

TSKX1: I find that completing the tasks on the Taskcn.com is: 1=not difficult at all, 7=extremely difficult.

TSKX2: Completing the tasks on the Taskcn.com is a challenge to me.

TSKX3: I find the tasks on the Taskcn.com are very complex.

Self-efficacy (SEFC): Adapted from Kankanhalli et al. (2005)

SEFC1: I am competent at completing the tasks on the Taskcn.com.

SEFC2: I have the expertise needed to complete the tasks on the Taskcn.com.

SEFC3: I have confidence in my ability to complete the tasks on the Taskcn.com.

* Items dropped in the analysis.

Appendix B.

Following the steps proposed by Zhou et al. (2007), we estimated three models:

1. M1 was a method-only model in which all items were loaded on one factor ($\chi^2 (77) = 872.40$, RMSEA=.225).

2. M2 was a trait-only model in which each item was loaded on its respective scale ($\chi^2 (67) = 176.42$, RMSEA=.089).

3. M3 was a trait and method model in which a common factor linking to all the measurement items was added into M2 ($\chi^2 (53) = 105.93$, RMSEA=.072).

Because M2 is highly better than M1, while M3 is only slightly better than M2, the trait rather than the common-method factor explains most of the variance. Common-method bias does not pose a major threat to the study.

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