Understanding Satisfaction of Knowledge Contributors in Transactional Virtual Communities: A Cost-Benefit Tradeoff Perspective

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1. Introduction

The Internet revolution, such as the emergence of Web 2.0, has led to the proliferation of virtual communities (VCs) all over the world [30]. The bloom of such VCs enable knowledge and information exchange for mutual learning or problem solving without physical constraints [25, 30, 49, 50]. The most commonly known VCs are professional virtual communities (PVCs) or virtual community of practice (CoP) [11, 25], where participants voluntarily share their knowledge with and acquire needed knowledge from others. However, the knowledge provided by participants in these VCs is taken as public good that is free to all participants, thus yielding no economic value. A call for extracting economic value from knowledge shared within virtual communities has recently motivated practitioners to explore opportunities for capitalizing on these knowledge to realize economic value [32].

Since 2005, a new form of virtual communities supporting this transformation, which we call transactional virtual communities (TVC) in our study, has emerged and rapidly developed worldwide. Most popular applications of TVCs include Amazon's Mechanical Turk and myTino.com in the US, and Taskcn.com and Witkey.com in China. We term these applications as TVCs to highlight their distinct knowledge exchange model: instead of contributing knowledge for free as in the traditional VCs, participants in TVCs transact their knowledge for economic returns. In other words, knowledge seekers post tasks and provide certain monetary compensations for sourcing others' knowledge to complete those tasks. TVCs are sometimes also named Witkey, connoting "the key of wisdom," or crowdsourcing, connoting sourcing ideas from the crowd [23].

The business model of TVCs has achieved enormous success over the past years. For instance, more than 20 websites adopt this business model in China, and the scale and revenue of these websites are also considerable. A typical website, such as Taskcn.com, already has more than 2.5 million

participants, over 20,000 tasks, and over USD3 million task rewards[一]. Likewise, over 80,000 knowledge sourcing requests, human intellectual tasks in their terms, have been posted on Amazon's Mechanical Turk.

The realization of the huge business potential of TVCs, however, hinges on the ongoing participation of their knowledge contributors (termed as "solvers" in this special research context [51]). After all, the economic value of this community model will not be realized unless solvers continue to spend their time and effort contributing their knowledge for problem solving [15, 43]. To ensure ongoing participation, prior research suggests that it is critical to keep participants satisfied with their experience in VCs [35, 36, 46]. Given the criticality of satisfaction, our study is purported to develop a better understanding of the factors predicting solver satisfaction with TVC.

Participant satisfaction has been studied in the traditional type of VCs primarily from a social, relational perspective [11, 30], due to the fact that knowledge is exchanged not based on monetary returns, but for social, relational reasons (e.g., following the principle of social exchange) [11, 48, 49]. However, in TVC, knowledge exchange has become a transactional or commercial activity (rather than a social activity) and the exchange principle is highly economic driven [5, 18]. Thus, the social perspective used in the prior VC research may not be contextually justified to explain solver satisfaction in our TVC context. Thus, we need to seek for a more contextually specific theoretical account, which reflects the economic exchange principle underlying the participation behavior in TVC, to explain solver satisfaction.

To this end, we draw on the goal attainment theory [7, 29, 42] to explain solver satisfaction in the TVC context, by attributing satisfaction to a trade-off evaluation of benefits and costs with regards to knowledge sharing behavior. Specifically, we do so by identifying two types of benefits (e.g., extrinsic and intrinsic benefits) and two types of costs (e.g., actual costs and opportunity costs) and incorporating the tradeoff evaluation between them using a concept called perceived net gain attainment (PNGA) .

[一] http://www.taskcn.com/

Our study offers two important contributions to the field of VC research. First, we provide theoretical insights into the determinants of solver satisfaction in TVCs by drawing on the goal attainment theory. Grounded on this theory, we highlight not only benefits but also cost concerns, particularly opportunity cost, as crucial factors in the context of TVC. Second, with the inclusion of both benefit and cost in our theoretical model, we add to the literature by establishing the importance of PNGA as a tradeoff between benefit and cost to solver satisfaction. Specifically, we stress that benefits cannot directly influence solver satisfaction but, together with costs, indirectly influence satisfaction through the full mediating effect of PNGA.

2. Theoretical Background

2.1. Distinguishing Transactional VCs from Relational VCs

A VC refers to an aggregation of individuals who share information around a common interest, where the sharing is supported and/or mediated by information technology and guided by certain protocols or norms [41]. We categorize VCs into relational VCs (RVCs) and transactional VCs (TVCs) according to the different protocols or norms guiding knowledge sharing. RVCs, which are the primary focus in prior VC research, treat knowledge as a public good that is free to all the members of VCs [48]. In accordance, knowledge sharing in RVCs is largely based on the principle of social exchange, rather than economic exchange. Guided by the social exchange protocol of knowledge sharing, prior studies on knowledge sharing in RVCs heavily focus on social factors, such as community advancement [11, 25, 48], social identity [14, 36], generalized reciprocity [11, 26, 48, 49], and norms [11, 14, 26].

However, knowledge sharing in TVCs follows a different protocol. In TVCs, knowledge is treated as a private good and can be priced and exchanged in a transactional manner. Specifically, knowledge seekers who want to ask others for help in resolving certain problems post their tasks on TVC and provide certain rewards (temporally kept by websites) for solvers. Solvers participate in these online tasks by submitting their works to the websites. Seekers then choose solvers who offer solutions that best meet their requirements as winners and ask the websites to pay monetary rewards to the winners.

For each transaction, the websites will hold part of the total rewards as the service fee, for example, about 20 percent of the total rewards.

Given the distinctive nature of TVCs, the role of economic calculus of benefits and costs should be recognized. More importantly, unlike the knowledge contributors in RVCs who may regard knowledge sharing behavior as either a side-product of private behavior [31] or an altruistic behavior [26, 48] thus paying less attention to the cost issues [6, 11, 34], in the TVC context, the goal of sharing knowledge becomes self-interest maximization. This implies that costs as an important decision factor for maximizing self-interest are no longer negligible. All of these ask for an alternative theoretical lens, preferably cost-benefit related, to analyze solver satisfaction with knowledge exchange in the TVC context.

2.2. Satisfaction with VCs and goal attainment theory

Participant satisfaction with VCs is a critical issue for research on VCs because it is closely associated with participants' continuous participation in VCs which will determine the sustainability of VCs [15, 43]. While there have been studies on the antecedents of satisfaction in the RVC context, they may not be most appropriate to explain solver satisfaction in TVC. For instance, some of those studies are based on general research framework, such as the information system success model [13, 35] or the expectation confirmation theory [4, 39], and therefore are too general to identify context-specific antecedents of satisfaction in TVCs. Other studies investigate social factors, such as social identity [36], based on the social exchange principle, and therefore are more appropriate to the RVC, rather than the TVC context. Context-specific explanations for solver satisfaction in the TVC context that reflects the economic exchange principle have not been developed. This drives us to search for a theory that can capture the economic exchange nature of the research context. To the extent that the benefit and cost concerns are the basis of any economic exchange principles [5, 18], we believe that goal attainment theory [7, 29, 42], which explicitly incorporates the cost-benefit calculus, is a more appropriate theory to explain satisfaction in TVCs.

Goal attainment theory was first developed by King [29] in the context of nursing. One central tenet of the theory is that people set certain goals, and the extent to which these goals are attained will determine their satisfaction. The theory is later applied and extended by Reinig [42] and Briggs et al. [7] to the information system research (see Fig. 1). They put forward perceived net goal attainment (PNGA) as a concept to capture the extent to which the goals are attained and define it as "the degree to which one perceives that some object of satisfaction either advances or hinders the attainment of one's salient individual goals" [7] (p. 588). Drawing on the cost-benefit analysis, the theory further posits that perceived benefits can advance the net goal attainment while perceived costs will hinder the net goal attainment. Therefore, PNGA, as an overall evaluation in terms of benefits and costs, is positively associated with perceived benefits but negatively associated with perceived costs.

==INSERT FIG. 1 HERE==

The goal attainment theory also postulates the mediating role of PNGA between perceived benefits, perceived costs, and satisfaction. Specifically, the theory posits that perceived benefits and costs do not directly influence satisfaction but through the tradeoff between these two aspects, which means that high benefits may not necessarily lead to high satisfaction if costs are also high. People form their feelings of satisfaction not solely based on what they gain or lose but according to the tradeoff between benefits and costs [42]. PNGA largely plays the role of this proxy. When the benefits of fulfilling goals exceed the costs of attempting to fulfill these goals, positive PNGA leads to satisfaction. In contrast, when individuals perceive that the benefits are not worth the costs involved in fulfilling the goals, they may feel dissatisfied. Therefore, perceived benefits and costs influence PNGA, which in turn affects satisfaction. In other words, PNGA is a mediator between perceived benefits, costs, and satisfaction.

2.3. Benefits and costs in TVCs

Perceived benefits can be classified into extrinsic benefits, which are relevant to doing something because it leads to a separable outcome, and intrinsic benefits that are relevant to doing something because it is inherently interesting or enjoyable [43, 44]. In our TVC context, extrinsic benefits mainly

refer to the monetary rewards provided by seekers as compensation for solvers' time and effort expended on online tasks, whereas intrinsic benefits refer to the benefits inherently residing in the online task participation process, such as perceived enjoyment and sense of self-worth.

Perceived costs can be manifested in two aspects: actual and opportunity cost [26]. Actual cost is the value of resources that have been actually used for doing something. Thus, it can be directly measured by money or other explicitly measurable resources. For example, the money paid for buying a product is an actual cost of purchase behavior. In contrast, as a concept drew from economics, opportunity cost is defined as the value of the next best alternative forgone as the result of making a decision [38]. It is relevant to the actual cost but not equal to it, because it represents the possible value generated by the resources if they are invested in other activities [8]. This is based on the assumption that, because resources are scarce and choices are exclusive, only efficient use of these resources can bring optimal profits [8]. Therefore, opportunity cost must be necessarily reckoned within a subjective utility dimension, because it cannot be represented in some objectively measurable commodity or resource dimension, indicating an implicit hidden cost [8]. As such, we define actual cost as the knowledge, effort, time, and other resources that solvers spend on completing the focal online task and opportunity cost as the perceived value of these resources if they are used to do other things rather than for the focal online task.

3. Hypotheses development

Based on this theoretical framework, our research model is proposed, as shown in Fig. 2. In the model, two types of benefits (i.e., extrinsic and intrinsic benefits) and two types of costs (i.e., actual and opportunity costs) are considered as antecedents of PNGA, which in turn influences solver satisfaction.

==INSERT FIG. 2 HERE==

According to the goal attainment theory, the extent to which one is satisfied is determined by the extent to which his/her goal is attained [7]. Thus, PNGA as a factor capture the goal attainment should affect satisfaction. PNGA is also similar with several other concepts that also describe the tradeoff

between benefits and costs including perceived value, net benefit, net equity, or equitable needs fulfillment in the decision-making or motivation research [2, 28]. Empirical studies have also validated the positive relationship between these factors and satisfaction [7, 42]. Therefore, we propose that

H1a: PNGA is positively associated with solver satisfaction in TVCs.

The goal attainment theory suggests that PNGA should mediate the effects of perceived benefits and perceived costs on satisfaction [42]. If a solver recognizes that participating in an online task can bring high rewards, the solver may not choose to participate in this online task, because the high costs may neutralize the benefits and lead to low PNGA. This means that high benefits cannot directly determine solver satisfaction but indirectly influence it through PNGA. Similarly, low costs may not bring high satisfaction when benefits are also low. Thus, PNGA should be a necessary mediator between benefits/costs and satisfaction. Therefore,

H1b: PNGA mediates the effects of perceived benefits and perceived costs on solver satisfaction in TVCs.

In TVCs, knowledge exchange is considered an economic exchange rather than a social exchange; thus, the role of extrinsic benefit should be highlighted. In regarding knowledge as a private good, people tend to exchange knowledge through market mechanisms to receive commensurate benefits [48]. Extrinsic benefit becomes a major goal that solvers try to attain in economic exchanges [48]. In some studies investigating knowledge exchange in RVCs, where social factors play an important role, extrinsic benefits have also been found to be associated with knowledge exchange [25, 26]. We argue that extrinsic benefit should become more important when solvers form their perception of goal attainment in the TVC context. As people tend to maximize benefits and minimize costs in an exchange [7, 42], when extrinsic benefit is high, solvers will also perceive high net goal attainment, indicating a positive relationship between them. Thus, we propose the following:

H2: Extrinsic benefit is positively associated with PNGA in TVCs.

In addition to extrinsic benefits, participating in online tasks can also bring several intrinsic benefits to

solvers. The intrinsic benefits also can evoke individual behavior because these benefits can satisfy their needs for competence [43, 44]. Their relationship has been validated by prior studies in RVCs which show that people will engage in knowledge contribution when they feel a sense of self-worth and achievement [6, 26, 34]. In this study, we further propose intrinsic benefits as an important aspect for solvers to assess the goal attainment for two major reasons. First, solvers participate in online tasks because these tasks are inherently interesting. Although knowledge exchange in TVCs is an economic exchange, task participation behavior is still voluntary. Thus, solvers can freely choose the tasks that they are interested in, indicating an intrinsic motivator of their behavior. Second, task participation can bring solvers a sense of self-worth or achievement. Solvers participate in TVCs online tasks not only to gain extrinsic rewards but also to exhibit their ability to solve problems Similar to knowledge contributors in RVCs,. Therefore, we argue that intrinsic benefit positively influences solvers' perceived net goal attainment.

H3: Intrinsic benefit is positively associated with PNGA in TVCs.

As discussed earlier, both actual and opportunity costs are factors that assess the losses that solvers suffer when participating in online tasks. According to the goal attainment theory [7, 42], people tend to maximize benefits and minimize costs to obtain more net benefits, which are presented as PNGA. so actual and opportunity costs should be negatively associated with PNGA. Specifically, actual cost reflects solvers' evaluation on losses based on the real resources used in the task participation process. Given the same benefits, a task requiring more time and effort will lead to relatively low PNGA. Opportunity cost reflects an implicit and hidden cost due to the resource scarcity and choice exclusiveness [26], which means that the solver has to forgo some value for participating in the focal online task. If the resources used to complete an online task can bring high value when they are spent on other activities (e.g., high opportunity cost), the PNGA will be low because solvers lose the opportunity to use the resources more efficiently and to obtain more benefits. Therefore,

H4: Actual cost is negatively associated with PNGA in TVCs.

H5: Opportunity cost is negatively associated with PNGA in TVCs.

Although both actual and opportunity costs may influence PNGA, the effect strength of these two types of cost may be different. In economics, researchers suggest using opportunity rather than actual cost as the measure of cost in economic analysis because opportunity cost is better than actual cost in capturing the true cost of a course of action [8]. The fundamental rule of economic analysis is utility maximization, which requires that all resources be utilized completely and appropriately, that is, economically efficient [37]. Actual cost, which is simply measured by the objective resources expended in the action, may not be able to properly capture the true cost because this measure cannot provide implications on whether these resources are efficiently used or not. In contrast, opportunity cost, which is defined as the value generated by the forgone alternatives, is closely associated with the comparison between alternatives and can be used as a variable to reflect economic efficiency. Therefore, when faced with a choice among several exclusive alternatives, an economic person tends to use opportunity cost rather than actual cost as the basis for decision making [37]. This implies that opportunity cost should play a more important role than actual cost when people form their value perceptions (e.g., PNGA).

In the TVC context, solvers need to expend resources, including time and effort, to complete online tasks. To utilize these resources most efficiently, they will compare the value generated by participating in online tasks versus other alternatives, such as rest or other leisure activities. Thus, when making a decision on whether to participate in online tasks, a more rational approach for solvers is to evaluate cost using opportunity rather than actual cost. That is, opportunity cost should have a stronger effect on PNGA than actual cost.

H6: The relationship between opportunity cost and PNGA should be stronger than the relationship between actual cost and PNGA.

4. Methodology

4.1. Setting and participants

Data were collected through a field survey in a TVC (also called "Witkey") in China. In recent years, there has been a rapid development of knowledge-intensive industries, and numerous knowledge

sourcing TVCs have emerged in China. The emergence of knowledge sourcing TVCs has provided knowledge workers with an opportunity to leverage their knowledge to obtain additional income outside of their work time. Moreover, considerable small and medium enterprises need to acquire knowledge-based product or services through TVCs to reduce costs. Therefore, China has taken a leading position worldwide in developing TVCs [51]. Over 20 Witkey websites are active in China, and the scale of TVCs is developing fast. Taskcn.com is one of the most popular Witkey websites in China, with more than 2.5 million solvers and over 20,000 tasks worth USD3 million.

Although there are many types of tasks posted on Taskcn.com, such as design, programming, strategic planning, and writing [51], we only focused on IT-relevant tasks, where the final product should be an IT artifact (e.g., a website, a program, or a computer-aided logo design). IT-relevant tasks were selected for two reasons. First, IT-relevant tasks account for the greatest portion of the total tasks on TVC websites in China. For example, the ratio is over 70 percent on Taskcn.com. Thus, this study captures the major component of online tasks in TVCs. Second, the IT-relevant tasks are more knowledge-intensive, requiring solvers to invest a large amount of resources, such as knowledge, time, and effort, in the task fulfillment process. This is consistent with our research objective of understanding the knowledge exchange behavior in TVCs. Several other tasks, such as naming a baby, require little knowledge, and are not suitable for this study. Thus, only solvers who have experience in IT-related tasks are eligible to participate in the survey.

4.2. Instrument

Instruments for most of the constructs were adapted from prior relevant studies except for opportunity cost (see Appendix). Slight wording modifications were applied to fit the research context, and all measures used the seven-point Likert scale. To measure extrinsic benefit, we employed three reflective items of the organizational reward, which was used in the organizational context [26], but adapted to the TVC context by focusing on the monetary rewards. Subjects were asked to assess the extent to which they think participating in online tasks can bring them monetary rewards. Actual cost was measured using three formative items from Kankanhalli et al. [26], capturing subjects' opinion

about their time, effort, and other resources expended in online tasks. Adapting four formative items from Ke et al. [27] and Roberts et al. [43] for intrinsic benefits, we asked the subjects to assess the extent to which they feel that participating in online tasks is interesting and pleasant, and the extent to which they feel a sense of self-worth or achievement. Four reflective items adapted from Briggs et al. [7] were used to measure PNGA. These constructs were measured using a seven-point Likert scale that ranged from "strongly disagree" to "strongly agree." Satisfaction was measured by four reflective items adapted from Bhattacherjee [4]. These four items are also seven-point Likert scales ranging from one extreme to the other extreme, for example, from "very dissatisfied" to "very satisfied." Because of the lack of instrument for opportunity cost in prior studies, we developed measurement items according to the construct definition.

Opportunity cost is treated as a formative construct which can be assessed in terms of three types of value brought by alternative activities. First, the neoclassical microeconomic model of labor supply proposes that people's utility function is determined by the choice between work and leisure [22]. Participation in online tasks will reduce solvers' time for relaxing, thus loss caused by this reduction becomes a part of the opportunity cost. Second, research in organizational behavior posits that work-family conflict is an important issue when employees make a decision on working time [20]. Having less time to share enjoyment with family is the second source of opportunity cost of participating in online tasks. Third, from the perspective of investment, the resources invested on online tasks can also bring certain value when they are invested in other projects [38]. The loss for not investing in other projects also becomes a source of opportunity cost. Thus, we developed the instrument of opportunity cost according to these three aspects. After the items were developed, the definition and the items of opportunity cost were given to three Information Systems Ph.D. students to confirm the face validity.

4.3. Procedure

Subjects were recruited through two channels. First, we took the survey as an online task and posted it on the Taskcn.com website. In the task description, we introduced the objective of the study and the

requirement for participation: Only 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 webpage was also shown in the description. A lucky draw with a success rate of 10 percent would be conducted, and each winner could gain RMB20 (about 3 USD). The second channel for collecting data was through sending e-mails to solvers with experience in IT design tasks. We first identified about 30 IT-relevant tasks open in the past month before the survey and then recorded the solvers participating in these tasks. After removing the solvers with repeated usernames from the list, we randomly selected 700 participants as the target respondents. We sent in-site e-mail invitations to the target solvers. In the e-mail, solvers were informed of the objective of the study, the URL of the survey task webpage on Taskcn.com, and the questionnaire webpage. Two weeks later, we sent a reminder e-mail to those who had not completed the questionnaire. The incentive mechanism was the same with the first channel.

We obtained 140 and 146 responses through the two channels, respectively. Among the responses gathered through the first channel, 3 were incomplete, 3 were repeated, and 75 subjects had never participated in any IT design project before. After removing these inappropriate responses, there were 205 usable responses. To estimate the response bias, we compared the mean value of the questions for the early 50 respondents and the late 50 respondents (about the first and the last 1/4 of the whole sample) and found that there were no significant difference between these two groups for most of the questions except PNGA2, suggesting that response bias was not a concern for the study [45].

==INSERT TABLE 4 HERE==

The demographics of the respondents are shown in Table 4. They were consistent with the population of Taskcn.com participants, most of whom were young, skilled in computer and with high education level. When comparing the demographics of the respondents from the two data collection channels, we found that there were no significant differences in gender (χ^2=0.048, p=0.827), age (χ^2=7.937, p=0.160), education (χ^2=5.613, p=0.132), experience in computer (χ^2=3.819, p=0.282), experience in Internet (χ^2=3.373, p=0.338), and experience in Witkey (χ^2=7.453, p=0.114). To ensure the external

validity of our proposed model, we used the data collected from the second channel (N=146) to test our hypotheses and used the data collected from the first channel (N=59) to validate the consistency of the conclusions. Thus, the samples for the second channel and the first channel were taken as the test set and the control set respectively.

5. Data analysis

Partial Least Squares (PLS) was used to test the research model because of the several advantages of this technique. First, as a second-generation structural equation modeling (SEM) technique, it can estimate the loadings (and weights) of indicators on constructs (hence, assessing construct validity) and the causal relationships among constructs simultaneously [16]. Second, in comparison with covariance-based (CB) SEM, PLS can avoid restrictive distributional assumptions (e.g., normal distribution) because it uses the ordinary least squares regression and bootstrapping technique, and it is most suitable for models with formative constructs and relatively small samples [19], which is the case in our study. Based on the above considerations, PLS was chosen for the current study. Specifically, SmartPLS was used as the analytic tool.

5.1. Measurement model

The reflective and formative constructs were assessed differently. The reflective constructs (e.g., extrinsic benefit, perceived net goal attainment and satisfaction) were evaluated by checking their reliability, convergent and discriminant validity. Reliability can be examined by composite reliability (CR) and average variance extracted (AVE) [17]. As shown in Table 2, CR and AVE for all constructs exceeded the threshold value of 0.60 and 0.50, respectively [17, 24], exhibiting good construct reliability. Convergent validity was examined by checking the item loadings on the respective constructs. The initial analysis showed that except the third item of extrinsic benefit EXB3, the loadings for other items were greater than 0.70. Upon more closely examining EXB3, we found that it may be measuring whether or not the task seekers provide rewards to task solvers in general. This is different from whether or not the respondent believes that he/she can benefit or gain monetarily. Thus, it cannot exactly reflect the concept of extrinsic benefit. After removing EXB3, all item loadings were

greater than 0.80 (see Appendix), suggesting good convergent validity [1]. Discriminant validity was examined by comparing the square root of a construct's AVE and the correlations relevant to this construct [17]. If the square root of the AVE is greater than all correlations relevant to the construct, then discriminant validity is achieved. Table 2 shows that the square root of AVE was greater than the correlations for all reflective constructs, indicating good discriminant validity.

==INSERT TABLE 2 HERE==

The formative constructs were examined by checking their item weights, loadings and variance inflation factors (VIF) [40]. As shown in the Appendix, most of item weights were significant except for IXB1, ACST1 and OCST2 which indicates that these three items were of low *relative* importance [9]. A further analysis showed that the loadings for these three items were above 0.80 and significant, suggesting that these items were of high *absolute* importance [9]. The multicollinearity among the formative items were further examined and the results showed that the VIFs for all items were below 5, suggesting the multicollinearity was not a concern [21]. Thus, these three items were kept to maintain the completeness of the content coverage of the construct [9].

We also evaluated the threat of the common method bias using Liang and Xue's [33] method and found that the proposed constructs explained 78.7% of the overall variance while the method factor only explained 0.8% of the variance, suggesting that common method bias was not a concern for this study. Further, we also conducted the Harman's single-factor test and found that the first primary component explained 34% of the variance, confirming that CMB is not a critical issue.

5.2. Structural model

Fig. 3 shows the results of the proposed model. As shown in Fig. 3, PNGA had a significant positive effect on solver satisfaction for both the test set ($\beta = 0.696$, $t = 22.823$, $p < 0.010$) and the control set ($\beta = 0.659$, $t = 22.471$, $p < 0.010$), supporting H1a. Fig. 3 also shows the significant effects of extrinsic benefit ($\beta = 0.224$, $t = 4.792$, $p < 0.010$ for the test set and $\beta = 0.272$, $t = 6.946$, $p < 0.010$ for the control set), intrinsic benefit ($\beta = 0.506$, $t = 13.775$, $p < 0.010$ for the test set and $\beta = 0.231$, $t =$

4.604, $p < 0.010$ for the control set), and opportunity cost ($\beta = -0.127$, $t = 2.016$, $p < 0.050$ for the test set and $\beta = -0.336$, $t = 6.292$, $p < 0.010$ for the control set), and the insignificant effect of actual cost ($\beta = 0.034$, $t = 0.9869$, $p > 0.100$ for the test set and $\beta = -0.041$, $t = 0.971$, $p > 0.100$ for the control set) on PNGA. Thus, H2, H3, H5 were supported, but H4 was not. All of these results are consistent for the test set and the control set. The proposed model explained 43.0% variance for PNGA ($f^2 = 0.754$)[=] and 48.5% variance for satisfaction ($f^2 = 0.942$) for the test set and explained 33.0% variance for PNGA ($f^2 = 0.493$) and 43.4% variance for satisfaction ($f^2 = 0.767$) for the control set, suggesting the moderate level of R-squares [10] with a large effect size [12].

==INSERT FIG. 3 HERE==

The mediating effect of PNGA was tested following Baron and Kenny's [3] causal step approach. As shown in Table 3, a three-step analysis was conducted: (1) examine the direct effect of independent variable (IV) on dependent variable (DV); (2) test the relationship between IV and mediator; and (3) test the effect of IV on DV when the mediator is added. The results showed that the direct effect of actual cost on satisfaction was not significant ($\beta = 0.131$, $p > 0.100$ for the test set and $\beta = 0.144$, $p > 0.100$ for the control set), suggesting there was no mediating effect. For extrinsic benefit ($\beta = 0.329$, $p < 0.01$ for the test set and $\beta = 0.318$, $p < 0.01$ for the control set) and opportunity cost ($\beta = -0.225$, $p < 0.01$ for the test set and $\beta = -0.236$, $p < 0.01$ for the control set), they had significant effects on satisfaction but their direct effects on satisfaction became insignificant when PNGA was included (for extrinsic benefit, $\beta = 0.048$, $p > 0.100$ for the test set and $\beta = 0.066$, $p > 0.100$ for the control set; for opportunity cost, $\beta = -0.113$, $p > 0.100$ for the test set and $\beta = 0.043$, $p > 0.100$ for the control set), suggesting full mediating effects of PNGA (see Table 3). However, it was found that intrinsic benefit had a significant effect on satisfaction ($\beta = 0.177$, $p < 0.05$ for the test set and $\beta = 0.205$, $p < 0.05$ for the control set) even when PNGA was included in the model, suggesting that its impact on satisfaction was partially mediated by PNGA. Thus, in Figure 4, we reported the results of the alternative model which included the direct effect of intrinsic benefit on satisfaction.

[=] f^2 is used as the measure for the effect size where $f^2 = R^2 / (1-R^2)$ [12].

==INSERT TABLE 3 HERE==

==INSERT FIGURE 4 HERE==

To examine the different effects of actual and opportunity costs on PNGA, we employed the path coefficient comparison approach proposed by Chin [10]. The results showed that the relationship between PNGA and opportunity cost (β = -0.122 for the test set and β = -0.341 for the control set) was stronger than the relationship between PNGA and actual cost (β = 0.034 for the test set and β = -0.037 for the control set) with $\Delta\beta$ = .088, t= 14.951 for the test set and $\Delta\beta$ = .304, t= 55.990 for the control set, lending support to H6.

6. Discussions

6.1. Key findings

This study has examined the factors that influence solver satisfaction in the TVC context based on the goal attainment theory. First, a distinctive finding of our study is that opportunity cost negatively influences PNGA, indicating that when solvers perceive the forgone loss induced by participating in online tasks rather than other activities as high, the benefits brought by task participation behavior becomes devaluated and dissatisfaction will be felt. Second, the results reveal that both extrinsic and intrinsic benefits influence PNGA, suggesting that extrinsic benefit becomes a motivator driving solvers' participation behaviors when the knowledge exchange changes from a social exchange to an economic exchange. Third, our study shows that PNGA fully mediates the influence of extrinsic benefit, intrinsic benefit, and opportunity cost on solver satisfaction. The mediation effect of PNGA reveals that extrinsic benefit, intrinsic benefit, and opportunity cost cannot influence solver satisfaction unless they are transformed into PNGA. The cost–benefit tradeoff of the PNGA is a necessary hinge that bridges the perceptions of benefits and costs and solver satisfaction.

However, the effect of actual cost on PNGA is not found to be significant. A possible explanation could be because in the human decision making process, opportunity cost rather than actual cost can better capture cost perception. Actual cost reflects the objective input or resources expended in the online task participation behavior, whereas these resources can have different subjective values for the

alternatives available for different solvers. For those who consider the resources used for online tasks to bring more value by participating in other activities, participating in online task may be not a good choice. In contrast, those who consider participating in online tasks to bring more value will advocate participation behavior. Therefore, opportunity cost rather than actual cost appear to be a more appropriate measure of people's cost perception, which is associated with PNGA and satisfaction.

6.2. Theoretical implications

This study advances the theoretical development in the area of knowledge sharing in virtual communities by investigating a new research context (i.e., TVC) and advancing the understanding of knowledge sharing in this TVC context from an alternative perspective. Specifically, this study contributes to existing literature in three aspects.

First, to the best of our knowledge, this is the first study theorizing the knowledge sharing behavior of solvers in the TVC context. Most prior studies on knowledge sharing in VCs provided a good understanding on the underlying mechanisms of knowledge sharing in the RVC context, but whether these mechanisms are still applicable in the TVC context were not explored. This study contends that TVC and RVC are different in the nature of the principles governing the knowledge exchange. These contextual distinctions further suggest that economic factors (e.g., perceived benefits and costs) rather than social factors (e.g., reciprocity) should significantly contribute to solver behavior in TVCs. The role of cost, which is not commonly considered in RVCs [31, 47, 48], should be emphasized in TVCs in particular.

Second, this study advances the theoretical understanding of perceived costs on knowledge sharing in TVCs by including opportunity cost as an important component of cost. Prior studies on knowledge sharing measured the cost of sharing exclusively through the evaluation of knowledge contributors on objective resources, such as codification effort and time. However, no significant effect of this type of cost on knowledge sharing behavior was confirmed [26]. One possible explanation can be attributed to the fact that actual cost, which is measured by the evaluation on objective resources, may not capture the true cost of an action [8]. Drawing upon the economic literature [38], our study

contributes to the extant literature by theorizing and empirically supporting opportunity cost, which reflects the subjective value of the objective resources, as a more appropriate form of cost than actual cost. Thus, researchers should use opportunity cost as a measure of cost in future research.

Third, this study is among the few studies that establish PNGA as the mediator among perceived benefits, perceived costs, and satisfaction [7, 42] in the TVC context. Prior studies on knowledge sharing in RVCs found a direct impact of perceived benefits on satisfaction. Situated in the context of TVC, where both benefits and costs are salient factors, our study suggests that PNGA is a more direct predictor of satisfaction than either benefits or cost alone. This finding has two important implications. On the one hand, when costs are no longer negligible, value is not equal to benefits but is determined by both benefits and costs. Neglecting any of these two aspects (i.e., benefits or costs) may lead to an inaccurate estimation of value. On the other hand, neither benefit nor cost can directly influence satisfaction; their effects are indirect through the mediation of PNGA. This implies that a tradeoff between benefits and costs is a necessary middle process before satisfaction is formed. Recognizing the mediating role of PNGA contributes to the prior understanding of satisfaction by revealing the underlying mechanism on how perceived benefits and costs influence satisfaction.

6.3. Practical implications

Several practical implications for both seekers and TVC websites can be derived from this study. With regard to seekers, there are two major implications. First, seekers should pay attention to the fit between task rewards and resources needed to fulfill the tasks. If the rewards are lower than the costs, the task cannot attract participants; if the rewards are greater than the costs, it means that seekers have to pay more for tasks. To achieve the fit between task rewards and costs, seekers should be aware of other similar tasks and see how they are priced, or consult TVC service providers on how to set rewards appropriately for difficult tasks. Second, seekers should pay attention to the opportunity cost of solvers and recognize individual differences. To achieve this, seekers may need to use the personalized rewarding strategy to set different rewards for different solvers according to their reputation and expertise because completing one task may involve different opportunity cost for

different solvers. Further, the demographics (e.g., education level and specific skills) and prior task participation experience can be used as the basis for setting personalized rewards.

With regard to TVC service providers, who are the intermediaries between solvers and seekers, they should provide enough support to facilitate information exchange and negotiation process between the two parties. To reduce information asymmetry between seekers and solvers, the TVC website can provide a benchmark price for specific kinds of tasks. Thus, seekers can provide appropriate rewards according to the benchmark price, and solvers can also base their decision making on the suggested criteria. The information asymmetry can also be reduced by providing personalized consulting services to seekers and solvers. For example, the service staff of TVC websites can offer suggestions to seekers and solvers on task pricing through e-mail or instant messaging tools (e.g., MSN and QQ). Second, TVC service providers should recognize that a TVC website is not only a place for working and earning money but also a platform for learning and gaining a sense of achievement. Therefore, TVC websites should provide certain services to meet the needs of solvers to gain intrinsic benefits. For example, TVC service providers can build a personal webpage for every solver where they can display their previous works, interests, and experience. Furthermore, TVC service providers can develop a discussion forum for solvers and seekers to communicate with each other. Solvers and seekers can also communicate with each other through e-mail and instant messaging tools. These services can satisfy solvers' needs for learning, achievement, and enjoyment, and motivate them to continue participating in online tasks.

6.4. Limitations and future research

Despite the valuable implications obtained from the results, this study has its limitations. First, the study was conducted on a specific TVC website in China. Although there are also similar websites in the US, such as Amazon's Mechanical Turk, they are different in the task types and reward scale: few IT-relevant tasks are posted on Mechanical Turk and no more than $10 rewards are provided to solvers. These differences may limit the generalizability of the conclusion to other websites. Second, prior studies on culture postulate that individuals with different cultural backgrounds have different

behavioral motivations: individualists are more likely to be motivated by extrinsic and instrumental incentives, whereas collectivists tend to base their decision making on intrinsic and relational factors. Therefore, the effects of extrinsic and intrinsic benefits on PNGA and satisfaction may vary across countries with different cultures. Future studies should focus on the cross-cultural issue and compare results from different cultural contexts based on our proposed research model. Finally, the convenience sampling nature of the data may limit the generalizability of the results. Thus, the research model can be further examined by using more solid sampling strategies in future research.

7. Conclusion

As an early study on knowledge sharing behavior in the TVC context, this paper establishes the distinctions between RVCs and TVCs and provides some new understandings on solver satisfaction using the goal attainment theory. As knowledge exchange has been transformed from a social exchange activity to an economic exchange activity, the effects of various factors in the TVC context are different from those in the RVC context. Specifically, perceived benefits still play an important role, whereas perceived costs are no longer negligible in TVCs. Moreover, PNGA, which captures the tradeoff between benefits and costs, is confirmed to be a necessary mediator linking perceived benefits, perceived costs, and solver satisfaction. This study contributes to theories by extending the previous understanding on knowledge sharing in RVCs to TVCs and by theorizing on the important roles of cost and PNGA in this new context.

Appendix: Measures, Loadings and Weights

Reflective Constructs	*Loadings*	*t-statistics*
Extrinsic Benefit (EXB): Adapted from [26]		
• I will receive some monetary rewards in return for participating in online tasks.	.880	42.235
• Participating in online tasks can help me earn some money.	.846	27.967
• Seekers provide some monetary rewards to task solvers†.	[.600]	[5.301]
Perceived Net Goal Attainment (PNGA): Adapted from [7]		
• The tasks on the Taskcn.com are worth the effort that I put into it.	.868	61.092
• The things that are accomplished in participating in online tasks warrant my effort.	.880	62.242
• The results of participating in online tasks are worth the time I invest.	.889	59.942
• The value I receive from the online task participation activity justifies my efforts.	.864	46.394
Solver Satisfaction (SAT): Adapted from [4]		
How do you feel about your overall experience with the Taskcn.com?	.903	56.711
• Strongly dissatisfied/strongly satisfied.	.916	49.330
• Strongly displeased/strongly pleased.	.942	107.626
• Strongly frustrated/strongly contended.	.986	86.904
• Strongly terrible/strongly delighted.		

Formative Constructs	*Weights*	*t-statistics*
Intrinsic Benefit (IXB): Adapted from [27, 43]‡		
• Participating in the tasks on the Taskcn.com is very interesting.	.141	1.858
• The process of participating in the tasks on the Taskcn.com is very pleasant.	.246	3.051
• Participating in the tasks on the Taskcn.com lets me feel a sense of personal achievement.	.221	2.920
• Taskcn.com gives me a chance to do things I am good at.	.563	7.462
Actual Cost (ACST): Adapted from [26]		
• Participating in the tasks on the Taskcn.com will cost me much time.	.141	0.971
• The effort is high for me to participate in the tasks on the Taskcn.com.	.708	5.607
• Participating in the tasks on the Taskcn.com will cost lots of my resources (e.g., computer usage and knowledge).	.265	3.014
Opportunity Cost (OCST): Developed		
• When participating in the tasks on the Taskcn.com, I will lose the opportunity to have a good rest.	.622	3.894
• When participating in the tasks on the Taskcn.com, I will lose the opportunity to enjoy the time with friends and family.	.135	0.776
• When participating in the tasks on the Taskcn.com, I will lose the opportunity to earn more money by doing other things.	.332	2.481

†The third item of EXB was removed from the analysis due to its low loading.

‡We have also conducted the analysis by treating intrinsic benefit as a reflective construct and found no significant differences in conclusions.

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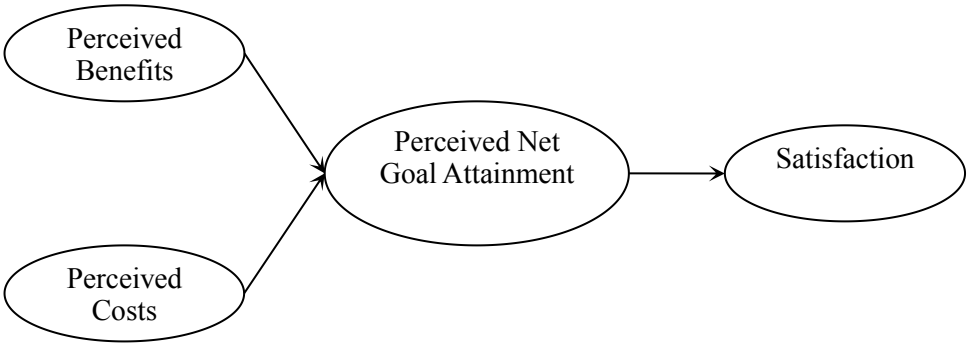

Fig. 1. Theoretical Framework [29, 30]

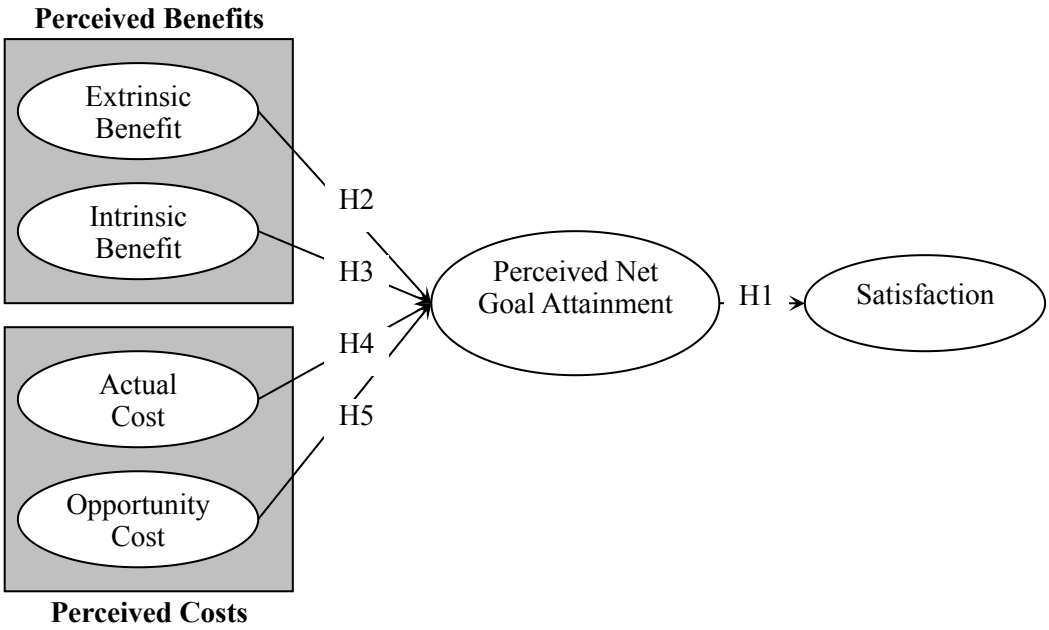

Fig. 2. Research Model

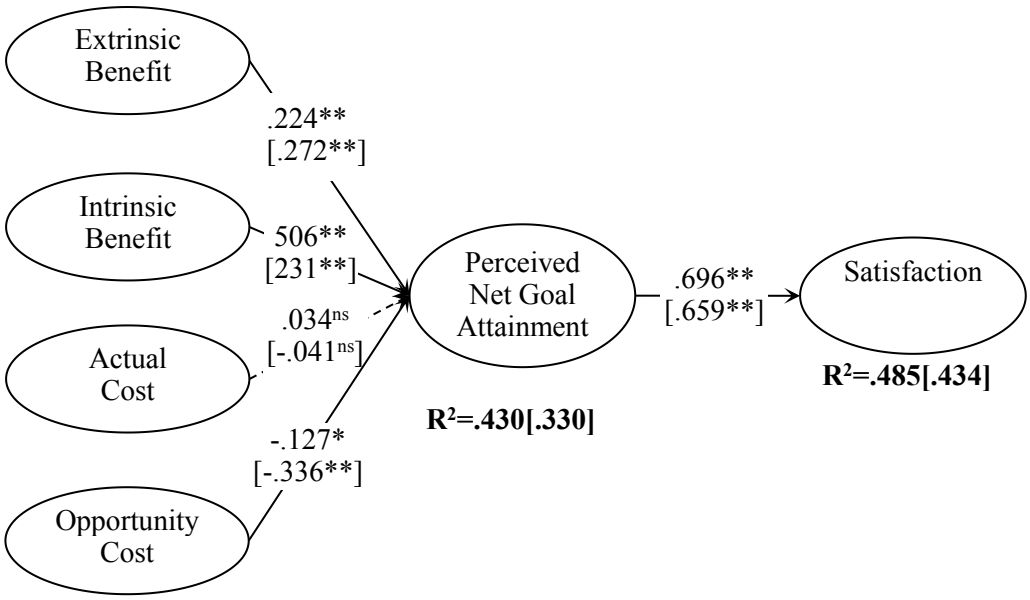

Fig. 3. PLS Results

Note: The numbers in and out of the brakets are the results for the data collected from the first (the control set) channel and the second channel (the test set) respectively. ^{ns}p>.1, *p<.05, **p<.01.

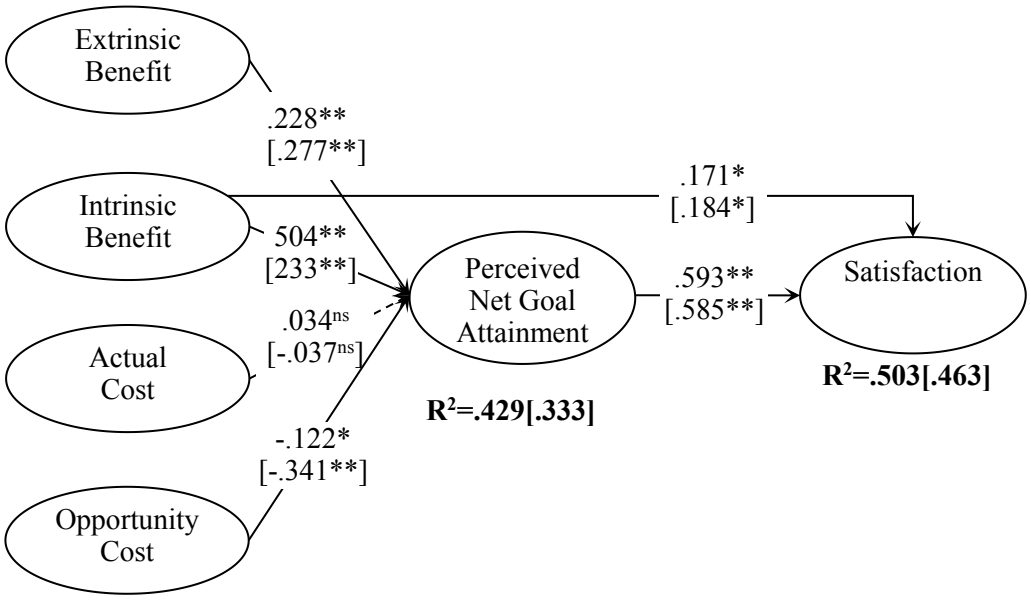

Fig. 4. PLS Results for the alternative model

Note: The numbers in and out of the brakets are the results for the data collected from the first (the control set) channel and the second channel (the test set) respectively. ^{ns}p>.1, *p<.05, **p<.01.

Table 1. 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 out of parentheses describes the frequency, while the number in the parentheses indicates the ratio.

** The number out of parentheses is the Chi-square value, while the number in the parentheses is the significance (p-value).

Table 2. Correlations

	Mean	S. D.	CR	AVE	SAT	PNGA	EXB	IXB	ACST	OCST
SAT	5.137	1.461	.959	.855	***0.925***					
PNGA	5.089	1.274	.929	.767	0.684	***0.876***				
EXB	5.424	1.264	.797	.572	0.347	0.414	***0.756***			
IXB	5.639	1.045	-	-	0.452	0.539	0.413	-		
ACST	4.966	1.223	-	-	0.097	0.192	0.189	0.337	-	
OCST	3.678	1.565	-	-	-0.199	-0.219	-0.068	-0.122	0.199	-

Note: CR=Composite Reliability, AVE=Average Variance Extracted, SAT=Solver Satisfaction; PNGA=Perceived Net Goal Attainment; EXB=Extrinsic Benefit; IXB=Intrinsic Benefit; ACST=Actual Cost; OCST=Opportunity Cost.
* The boldfaced numbers in the diagonal row are square roots of the average variance extracted.

Table 3. Test of Mediation Effects

IV	M	DV	IV → DV (c)	IV → M (a)	IV + M → DV		Mediation
					IV (c')	M (b)	
EXB	PNGA	SAT	.329**[.318**]	.416**[.420**]	.048^{ns}[.066^{ns}]	.677**[.641**]	Full
IXB	PNGA	SAT	.532**[.442**]	.611**[.412**]	.177*[.205*]	.590**[.588**]	Partial
ACST	PNGA	SAT	.131^{ns} [.144^{ns}]	-	-	-	Non
OCST	PNGA	SAT	-.225**[-.236**]	-.163*[-.401**]	-.113[.043]	.679**[.682**]	Full

Note: The numbers out of and in the brakets are the path coefficients for the test set and the control set respectively. IV=Independent variable; M=Mediator; DV=Dependent variable; ^{ns}p>.1,*p<.05, **p<.01.