

# The Effects of Prize and Scheduling Strategies in Crowdsourcing activities

Xiaohui Su<sup>1</sup>, Xiaoliang Feng<sup>2\*</sup> and Leiqing Peng<sup>3</sup>

<sup>1</sup>School of Business Administration, Guangdong University of Finance and Economics School, Guangzhou, Guangdong, China

<sup>2</sup>School of Business Administration, Guangdong University of Finance and Economics School, Guangzhou, Guangdong, China

<sup>3</sup>International Business School, Guangdong University of Finance and Economics School, Guangzhou, Guangdong, China

**Abstract.** Crowdsourcing provides an efficiency mode to explore crowd knowledge resource. It can provide diverse solutions for problem solving. However, how to design crowdsourcing strategies to drive crowd to participate in crowdsourcing activities is the focus of crowdsourcing platform management. Extant research mainly concentrated on prize strategy whereas little attention has been paid to scheduling strategy. Yet holistic crowdsourcing strategy should incorporate both scheduling strategy and prize strategy. Based on motivation incentive theory, this research applied over 154 thousand crowdsourcing projects' secondary data to examine the impact of crowdsourcing strategy. Both prize strategy and scheduling strategy have a positive effect on the number of participants. Furthermore, there is a positive interaction effect between prize and scheduling. These findings can enrich crowdsourcing theory and provide implications in crowdsourcing strategy design.

## 1 Introduction

Crowdsourcing is a form of public reward, where tasks are issued to the unspecified group of network problem solvers, and the awarding party selects the best among those who completed the bidding for award. Crowdsourcing mode builds a bridge between the demand of corporate knowledge and the supply of social idle knowledge resources, which is the third new problem-solving mode other than internal outsourcing and outsourcing. In addition, crowdsourcing is less economically costly than outsourcing because the awarding party only needs to pay the winning bidder's prize and does not have to bear the costs incurred by each participant in a crowdsourcing project. These characteristics make crowdsourcing a comparative advantage over internal outsourcing and outsourcing in solving knowledge-based problems in a network context<sup>[1]</sup>. Therefore, crowdsourcing have been widely applied in many fields such as new product development, advertising creativity, program design and marketing. However, due to the universality and low controllability of the participants, the results of crowdsourcing activities are full of uncertainties. Therefore, how to attract a certain number of participants has a significant impact on whether the crowdsourcing projects can achieve the desired effect.

How to effectively motivate the participants has become the key to the completion of crowdsourcing projects. Most prior research focuses on the extrinsic motivation of participants, and explores the impact of

prize quantity on participants' behaviors. However, there appear to be conflicting findings regarding the impact of prize quantity. Some work suggests that higher rewarding tasks should attract more participants than low-rewarding tasks<sup>[2]</sup>. At the same time, however, other research finds that high prize strategy is not conducive to project performance<sup>[3]</sup>. How does prize incentive affect the number of participants? This paper will further investigate the impact of prize quantity in crowdsourcing tasks.

Prize quantity is only a part of crowdsourcing strategy whereas time, as an important part of transaction cost, will also have a significant impact on participants' behaviors. However, previous studies on crowdsourcing strategies rarely explore the effect of time strategy, such as the time period of task duration. This paper will further investigate the impact of time period on participants' size. Moreover, as time strategy and prize strategy are components of crowdsourcing strategy, it is important for the awarding party to consider the effects of both. While most papers have explored the effect of prize quantity, there has been less attention paid to the synergistic effect between prize quantity and time period. Further, this study will examine the interaction effect between them.

## 2 Literature review and hypotheses development

### 2.1. Prize quantity and participants' size

\*Corresponding author's e-mail: [fengxiaoliang@gdufe.edu.cn](mailto:fengxiaoliang@gdufe.edu.cn)

The prize strategy refers to the setting of the task prize bid amount, including components such as the number of participants sharing the prize, the fixed or contingent mode, and the amount of prize<sup>[4]</sup>. Considering that prize quantity is a fundamental issue in the crowdsourcing strategy, this paper focuses on prize quantity in the prize strategy, which refers to the commitment of the awarding party to pay for the winning bidder and represents the expected economic benefits.

Extrinsic motivation refers to the motivation induced by external stimuli that are not intrinsically linked to the activity. In this context, participants do not choose to participate out of interest in the activity itself. External stimulus usually takes the form of economic rewards or other benefits, which can reinforce participants' behavior.

From motivation theory perspective, as a material reward for the human capital contributed by participants, prize can effectively activate the extrinsic motivation of participants in a crowdsourcing platform. Some studies have shown that prize was found to be the main driver of problem solvers' participation behavior in crowdsourcing platform incentive<sup>[6]</sup>. Furthermore, numerous studies have shown that the amount of prize can positively influence participants' willingness and motivation to participate. Tasks with higher rewards get more views, which in turn attract more problem solvers<sup>[7]</sup>. Liu<sup>[8]</sup> et al. found that the higher the amount of prize, the more the number of solutions obtained, but also the higher the quality of the solutions. In addition, a large number of studies on crowdsourcing platforms have shown that high prize is conducive to expand the size of participants and further improve the probability of task completion<sup>[9]</sup>.

In conclusion, prize quantity has a positive impact on the size of participants. Specifically, Tasks with higher rewards strongly stimulate participants' economic motivation, which in turn attract more participants. Therefore, we hypothesize the following:

H<sub>1</sub>: Prize quantity positively influences participants' size.

## 2.2. Time period and participants' size

Time strategy refers to the setting of time period of task duration, consisting of fixed and extended time period. The fixed time period refers to the task completion time proposed by the awarding party, while the extended time period means that the awarding party permits to extend the task completion time when the task target is not achieved. This study only focuses on the fixed time period of time strategy. Time period of task duration will affect the behavior of participants, which will affect the possibility of task completion in crowdsourcing activities<sup>[10]</sup>.

From the perspective of information setting, some studies have shown that putting a longer task time period can increase the exposure of the task and facilitate the increase of task views, thus attracting more participants. However, different task time period can stimulate distinct participants' motivation. Specifically, with a fixed amount of tasks, shortening the task time period would not only increase the labor intensity of the participants,

but also place higher demands on their abilities, which would further motivate participants' intrinsic motivation to self-challenge. Although participants can be attracted in crowdsourcing platforms by stimulating their intrinsic motivation of self-challenge, however, some work has shown that economic motivation is the dominant driver of participant behaviors<sup>[3]</sup>. Therefore, this study posits that participants are more effectively engaged by stimulating their extrinsic motivation as opposed to stimulating their intrinsic motivation. In conclusion, we propose that amplifying the task time period can entice more participants. Accordingly, this research postulates the following:

H<sub>2</sub>: Time period positively influences participants' size.

## 2.3. Prize quantity, time period and participants' size

We suggest that an effective combination of prize strategy and time strategy is designed to contribute to crowdsourcing performance. As far as bonus strategy is concerned, high bonus task has stronger stimulating effect on participants' economic motivation, which helps to further expand the scale of participants<sup>[8]</sup>. As far as the prize strategy is concerned, Tasks with higher rewards have a stronger stimulating effect on participants' economic motivation, which contribute to a further increase in participants' size<sup>[8]</sup>. In contrast, the low-prize tasks are designed to attract interested participants with the content of the task. In terms of time strategy, although shortening the task time period can stimulate participants' motivation to self-challenge and thus attract more problem solvers, the intrinsic motivation has less driving effect on the participants' behavior. Conversely, longer task time period have a weaker stimulating effect on participants' intrinsic motivation. However, extending time period can enhance the exposure of task information, and in turn more participants may browse the task, thus attracting more participants.

Based on the above analysis, it can be concluded that setting a longer task time period is conducive to expand the size of participants, regardless of whether the task is a high or low prize task. Specifically, high prize task can stimulate participants' economic motivation and further increase the number of participants. Low prize tasks, on the other hand, increase the probability of problem solving by attracting participants who are interested in the task content. Further, increasing the time of task completion can further increase the number of task views, thus improving crowdsourcing performance. Therefore, we hypothesize the following:

H<sub>3</sub>: There is a positive interaction between prize quantity and time period. When the task time period is longer, the positive effect of prize quantity on participants' size is greater, and vice versa.

In summary, we propose prize quantity and time period will be positively related to participants' size. Besides, there is a positive interaction between prize quantity and time period. The conceptual model of these hypotheses is shown in Fig. 1.

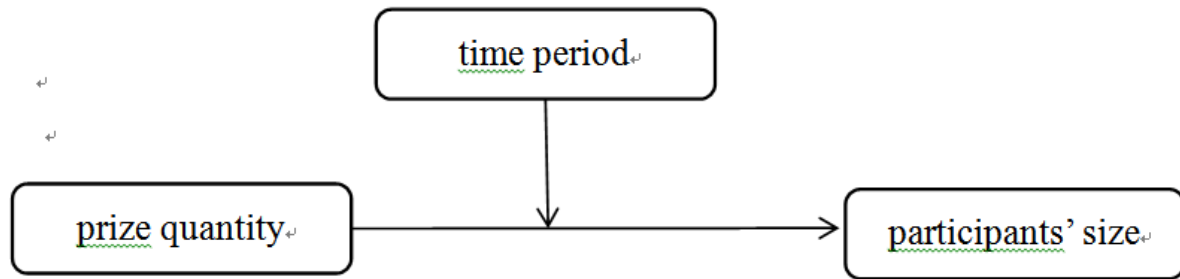


Figure 1. Conceptual model.

### 3 Methodology

#### 3.1 The sample and design

This study uses secondary data for hypothesis testing of the theoretical model. The data is obtained from a large crowdsourcing platform website in China, which was downloaded using web crawler technology. The data has the following three characteristics. Firstly, the data is authentic, taking the actual crowdsourcing projects as the research object. Secondly, the data is comprehensive, comprehensively collecting the relevant data information of the awarding party and participants of each task. Finally, the data contains a variety of tasks, such as design, creativity, translation and so on. The actual timing of task was mainly from 2008 to 2012. There were 154967 valid projects collected in the end.

#### 3.2 Measures

**Prize quantity:** It refers to the awarding party bid on the amount of task prize. We assessed prize quantity by the actual task price, which is consistent with the research of Liu et al. [8]. The prize quantity can be divided into high and low prize based on the mean value in the same type of task.

**Task time period:** We measured task time period by using the end time of the task minus the start time, and converted the measurement unit of time period into days.

**Participants' size:** It refers to the number of problem solutions obtained by the awarding party. We measured participant size using the actual number of solutions submitted, in line with previous studies[8].

**Control variables:** Certain potential factors were also been measured, such as the awarding party reputation and prize commitment. Moreover, the descriptive statistics and correlation analysis of variables are shown in Table 1.

Table 1. Mean, Standard deviation and correlation values of all variables in this study

Variables	Mean	SD	1	2	3	4	5
1.participants' size	240.00	332.32					
2.time period	11.86	11.80	0.23***				
3.awarding party reputation	3.10	0.95	0.10***	0.09***			
4.prize quantity	578.22	935.35	0.19***	0.34***	0.33***		
5.Prize commitment	1.99	0.12	0.04***	0.02***	0.16***	0.00	

a. N = 154967. \* p < 0.05, \*\* p < 0.01.

#### 3.3. Empirical model

The standard deviations and means vary widely between variables, which may result in smaller coefficients for some variables. Therefore, we standardized all variables. In purpose of testing hypothesis 1 and hypothesis 2, we tested the effects of prize quantity and time period on participants' size in regression model 1. To validate hypothesis 3, we tested the interaction effect of prize quantity and time period in regression model 2. In addition, some control variables that may affect the size of participants are added to all regression models, further excluding possible alternative explanations (see table 2).

### 4 Hypothesis testing

#### 4.1. The effects of prize quantity and time period

As we expected, regression results in model 1 suggested that both time period and prize quantity positively influenced participants' size (b=0.03, t=15.01, p<0.001), which indicated that the number of participants submitting solutions would also be higher when the amount of task prize was higher. As we expected, regression results in model 1 also demonstrated that time period had a positive effect on participants' size (b=0.22, t=117.06, p<0.001), which revealed that more

participants could be attracted when the task time period is longer.

attenuated when the task time period is shorter ( $b=0.01$ ,  $p<0.001$ ).

#### 4.2. The interaction effect of prize quantity and time period

As regression results in model 2 suggested, the interaction between time period and prize quantity was significant ( $b=0.15$ ,  $p<0.001$ ). To explore this interaction more closely, we examined the slopes of prize quantity at each level of time period [12]. Prize quantity had a stronger impact on participants' size when the task time period is longer ( $b=0.17$ ,  $p<0.001$ ), whereas the positive effect of prize quantity on participants' size was

#### 4.3. Analysis of control variables

Regression results in model 2 showed that the awarding party reputation was positively related to the number of participants ( $b=0.17$ ,  $p<0.001$ ), which suggested that the awarding party with a good reputation can attract more participants ( $b=0.37$ ,  $p<0.001$ ). Moreover, the regression results showed that prize commitment also had a positive effect on the number of participants ( $b=0.37$ ,  $p<0.001$ ), which showed that trust also conducted to engage more participants.

**Table 2.** Results of regression analyses

variable	Dependent variable: participants size	
	model 1	Model 2
<b>Predictor</b>		
prize quantity	0.03***	-0.04***
time period	0.31***	0.22***
<b>Interaction</b>		
prize quantity: time period		0.15***
<b>Control variables</b>		
Prize commitment	0.38***	0.37***
seeker reputation	0.14***	0.17***
R <sup>2</sup>	0.13	0.13
F	***	***

## 5 Discussion

We examined the impact of prize quantity and time period on participants' size and the interaction effect between them. Specifically, both prize quantity and time period had a positive effect on the number of participants. Furthermore, there was a positive interaction between prize quantity and time period. When the task time period is longer, the positive effect of prize quantity on participants' size is greater, and vice versa.

### 5.1. Theoretical contributions

Our work makes several important theoretical contributions. First, in this research, we used the actual secondary data to demonstrate the effects of prize quantity and time period. Specifically, high prize can enhance the economic motivation of participants and further improve the performance of crowdsourcing activities. What's more, time, as a component of transaction cost, has been paid less attention in previous literature. This study revealed that the longer time period can attract more participants.

Second, this study found that there was a positive interaction between prize quantity and time period. Prior research has rarely considered the combined effect of the two. In current research, we illustrated that more solutions could be obtained by appropriately extending the task time period, regardless of whether the task is a high or low prize task.

### 5.2. Practice implications

Our research has essential implications. Firstly, enterprises should pay attention to the effect of prize quantity. Although the purpose of crowdsourcing is to solve enterprise problems with relatively low cost, this study shows that high prize tasks can attract more participants. Therefore, moderately increasing the amount of prize can improve the possibility of the task being solved in the face of fierce competition.

Secondly, enterprises should reasonably design the combination strategy of time and prize. This study shows that there is a positive interaction between the amount of prize and the time period. Therefore, no matter whether the task prize is high or low, appropriately extending the task time period can attract more participants.

### 5.3. Limitations and Future Research

Although secondary data has the advantage of authenticity and objectivity in research methods, future research should be combined with experimental methods to verify the theoretical mechanism of this paper, which can further improve the validity of the research conclusions.

Since the most important purpose of the awarding party is to obtain high-quality solutions, we should study the impact of the amount of prize and time period on solutions' quality in the future. Although the size of participants is related to the probability of obtaining high-quality solutions, the quality of solutions is more related to the possibility of solving problems<sup>[13]</sup>.

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