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## A HYBRID CROWDSOURCING INCENTIVE MECHANISM BASED ON USERS' PREFERENCE

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**ABSTRACT.** Due to its nature, the success of a crowdsourcing application strongly relies on the volume of users' participation. Thus, crowdsourcing applications need elements that can motivate users to participate, such as incentives or rewards. In this paper, the development of a hybrid incentive mechanism that incorporated users' preferences is described. Literature review was first performed to identify the types of incentive implemented in existing crowdsourcing applications. This was followed by a survey through online questionnaire distribution to a total of 55 crowdsourcing users to determine their preference with regard to the identified incentive types. The hybrid incentive mechanism included most of the preferred incentive types indicated by the respondents. For the purpose of evaluation, two versions of crowdsourcing application prototype were developed, one of which was embedded with the hybrid incentive mechanism. Results obtained showed that participants who used the prototype with the incentive mechanism were more active in terms of number and contributions. Users' retention was also greater in prototype with embedded hybrid incentive mechanism.

**Keywords:** incentive mechanism, crowdsourcing participation, users' participation, users' preference

### INTRODUCTION

Crowdsourcing was defined as the act of taking a job traditionally performed by a designated agent (usually an employee) and outsourcing it to an undefined, generally large group of people in the form of an open call (Howe 2006). The unprecedented growth of crowdsourcing leads to the development of many crowdsourcing applications. It offers new pathways to connect users around the globe, allowing users to practice skills and enhance their ability depending on the types of application used. One of the most successful crowdsourcing applications to date is Waze (Waze 2016), which works as navigation application and offers advices on the best routes to take to avoid traffic congestion. Another example is iStockphoto (iStockphoto 2016), a free image sharing exchange used by a group of graphic designers where thousands of contributors uploaded their photos and charged each photo at a low rate. Due to their nature, the success of these applications depends on the number of participating users. Sustainability of a crowdsourcing application also depends on the volume of consistent users' participation. Thus, it is important to ensure that necessary elements that can attract and sustain users' participation are embedded into the crowdsourcing applications. One of these elements is incentive or reward. To be attractive and appealing, the incentive mechanism has to be designed according to users' preference. Therefore, in this paper, the

construction of a *hybrid* incentive mechanism for crowdsourcing applications that is based on users' preference is described. It combines both financial and non-financial rewards, hence the name hybrid. A literature review was first performed to identify the types of incentive discussed by researchers in the area. Then a survey was performed to identify the types of incentive preferred by users. Based on the survey outcome, the hybrid incentive mechanism was constructed, which was being embedded into a crowdsourcing application prototype. Evaluation was performed by comparing the number of users' participation and the number of contributions made using the prototypes with and without the incentive mechanism.

## TYPES OF INCENTIVE IN LITERATURE

Various types of incentive for crowdsourcing initiatives were found discussed in literature, which can be generally divided into two categories; financial and non-financial. Financial incentive involves monetary transfer provided directly to an individual with the intention to induce a behavioural change (Scott and Schurer 2008). Non-financial incentives on the other hand are benefits given for good performance or loyalty (Whitaker 2009). Non-financial incentives can exist in many forms including the following.

- **Level:** A system by which players are rewarded by an increasing value for accumulating points. Often features or abilities are unlocked as players progress to higher levels (Beza 2011; Preist, Massung, and Coyle 2014; Ueyama et al. 2014; Yang et al. 2012).
- **Point:** It can be used to reward users across multiple dimensions. Different categories of points can be used to drive different behaviours within the same site or application. Points can also be used as status indicator and users can use them to unlock access to certain contents (Bunchball Inc. 2010; Schweizer et al. 2012; Preist, Massung, and Coyle 2014; Ueyama et al. 2014; Yang et al. 2012).
- **Ranking:** In ranking, the top players are publicised to all players to increase competitiveness. The position in the ranking can be defined by points, levels, or number of votes (Pedreira et al. 2015; Preist, Massung, and Coyle 2014; Ueyama et al. 2014; Schweizer et al. 2012).
- **Leaderboard:** It is used to track and display desired actions, using competition to drive valuable behaviour (Bunchball Inc. 2010; Preist, Massung, and Coyle 2014; Yang et al. 2012; Schweizer et al. 2012).
- **Badge:** It is the visible recognition of having reached new levels or completed a number of challenges (Bunchball Inc. 2010; Ueyama et al. 2014; Yang et al. 2012; Schweizer et al. 2012).

## METHODOLOGY

The methods used in this research are survey, prototyping and controlled experiment. The survey was conducted to identify incentive types preferred by the users. Results from the survey were used to construct an incentive mechanism, which was embedded into a crowdsourcing application prototype developed. Using controlled experiment, the extent to which the incentive mechanism influenced users' participation was observed and measured.

### Survey on Incentive Preference

A survey was conducted in this research to identify the most preferable incentive types from users' perspective. The survey, which was performed using online questionnaire received a total of 55 responses from the users of non-profit crowdsourcing applications. The first part of the questionnaire comprised questions that collected demographics information of

the respondents. In the second part, respondents were first asked on whether or not financial incentive influence their participation in crowdsourcing initiatives, to which, a total of 42 (76%) respondents agreed. To non-financial incentive, a total of 39 (71%) respondents agreed. Next, the question asked respondents to rate the five types on incentive found in the literature above, including financial reward, according to their preference. Five-point Likert scale was used with five being the most preferred and one the least preferred. As can be seen from Table 1, badges scored the highest average of 4.00. The second highest was points with an average of 3.96. Levels and monetary reward average scores were 3.93 and 3.91 respectively. Ranking has low average rating, which is 3.51 while leaderboard has the lowest average rate which is 3.42.

**Table 1. Average Rate for the Most Preferable Incentive Mechanism to Implement in an Application.**

| Incentive Mechanisms | Mean Rating |
|----------------------|-------------|
| Badges               | 4.00        |
| Points               | 3.96        |
| Levels               | 3.93        |
| Monetary Reward      | 3.91        |
| Ranking              | 3.51        |
| Leaderboard          | 3.42        |

### Hybrid Incentive Mechanism Design

Findings from the survey showed that both financial and non-financial rewards are equally attractive to the users, even when they are using non-profit crowdsourcing applications. Thus, based on the results obtained from the survey, a ‘hybrid’ incentive mechanism comprising both financial and non-financial incentives was developed. The four types of incentive mechanism that obtained the highest average values as a result of the survey performed earlier were incorporated into the incentive mechanism. Furthermore, statistical analysis using Spearman Rank also indicated that these four types of incentive positively correlate with one another as shown in Table 2.

**Table 2. Relationships between the Highest Four Incentive Mechanisms.**

|        | Badges | Points               | Levels               | Monetary reward            |
|--------|--------|----------------------|----------------------|----------------------------|
| Badges | -      | $r=0.76024$<br>$p=0$ | $r=0.77796$<br>$p=0$ | $r=0.35777$<br>$p=0.00732$ |
| Points |        | -                    | $r=0.76284$<br>$P=0$ | $r=0.27915$<br>$p=0.03902$ |
| Levels |        |                      | -                    | $r=0.31422$<br>$p=0.01948$ |

The incentive mechanism begins with new account registration where their initial point is set to zero and initial level is one. Users receive “New User” badge after registration is completed. They may login once they are registered. Registered users are able to add data, update data, delete data, view data. For every data contributed, five points will be awarded. Users’ level will increase by one for every 25 points earned. When they have collected 250 points, they will only move one level up when their accumulated points increase by every 100. As for badges, they will receive new badge when their accumulated points increased by

50. The types of badge are “New User” badge, “Contributor” badge, “Active Contributor” badge, “Super Contributor” badge, “Best Contributor” badge and “Special” badge. A special badge will only be given to users who have collected 350 points and will obtain the next special badge when accumulated points increased by 100. Monetary reward will be given monthly to three users with the highest points every month. The monetary reward received by participants were thus tied to their performance.

### Evaluation

For the purpose of evaluation, two versions of crowdsourcing application prototype were developed and the hybrid incentive mechanism was embedded in one of the versions. Hence, the other version served as the control prototype. The prototype developed was a crowdsourcing website that crowdsourced grocery items’ prices from the users. Two groups of users were involved in the evaluation comprising of 11 users in each group. Participants in the first group were labelled from 1 to 11, while the second group of participants were labelled from 12 to 22. The first group was assigned tasks to contribute items prices (items) using the first version of the prototype with the embedded incentive mechanism and the second group was assigned to use the bare (control) prototype to perform the same tasks. The evaluation period ran for three weeks.

## RESULTS AND DISCUSSION

Table 3 and Table 4 shows the results obtained after the three weeks evaluation period was over. It can be seen that a total of 108 items were added by participants using the prototype with embedded incentive mechanism while a smaller number of 17 items were added by participants who were using the prototype without incentive mechanism. This is an indication the more number of items can be obtained with the presence of incentive mechanism in the prototype. Looking at the weekly performance, a total of 13 items were added using the prototype with incentive mechanisms during the first week, while 16 items were added using the prototype without incentive mechanisms. For the second week, only one item was added using the prototype with incentive mechanisms while there was no item added using the prototype without incentive mechanisms. For the final week of using the prototype, a tremendous increase in the total of items added using the prototype with incentive mechanism, which was 94 items while the prototype without incentive mechanism only had one item added.

**Table 3. The Weekly Results of Number of Items Added by Participants Using the Prototype with Incentive Mechanism.**

| Participants | 1 | 2 | 3  | 4  | 5  | 6 | 7 | 8 | 9 | 10 | 11 | Total |
|--------------|---|---|----|----|----|---|---|---|---|----|----|-------|
| First week   | 0 | 4 | 0  | 2  | 0  | 0 | 0 | 0 | 5 | 2  | 0  | 13    |
| Second week  | 0 | 0 | 0  | 0  | 0  | 0 | 0 | 1 | 0 | 0  | 0  | 1     |
| Third week   | 0 | 0 | 11 | 23 | 57 | 0 | 3 | 0 | 0 | 0  | 0  | 94    |

**Table 4. The Weekly Results of Number of Items Added by Participants Using the Prototype without Incentive Mechanism.**

| Participants | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | Total |
|--------------|----|----|----|----|----|----|----|----|----|----|----|-------|
| First week   | 2  | 4  | 0  | 1  | 2  | 0  | 0  | 4  | 0  | 0  | 3  | 16    |
| Second week  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     |
| Third week   | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 1     |

Looking at individual performance as shown in Table 4, for prototype with incentive mechanism, participant 9 contributed the most number of items using the prototype, which were five items, followed by participant 2 who contributed four items during the first week of

evaluation. Participant 4 and participant 10 both contributed two items each during the first week of evaluation. Sole contribution was made by participant 8 during the second week of evaluation using prototype with incentive mechanism. The number of contribution increased in the final week of evaluation. For the prototype with embedded incentive mechanism, participant 5 contributed the most number of items, which was 57, followed by participant 4 who contributed 23 items. Participant 3 and participant 7 contributed 11 and three items respectively. For the control prototype, as can be seen from Table 5, participant 19 contributed the most number of items, which was four, followed by participant 13 and participant 22 who contributed three items each using the prototype. Participant 16 and participant 15 contributed two items and one item respectively during the first week of evaluation. There was no contribution made using the control prototype during the second week of evaluation and during the final week of evaluation, only one participant contributed one item, which was participant 17.

Evaluation of this research shows that participants are more active in contributing information using the prototype with incentive mechanism compared to the bare prototype. Even though in the beginning of the evaluation participants who were using the bare prototype are more active than those who were using the prototype with incentive mechanism by a small margin, over a longer period of time, prototype with incentive mechanism managed to retain more contributions from more participants. Similar results were also found by (Massung et al. 2013), it was proven that participants who received monetary reward based on performance using hybrid incentive mechanism were more diligent in contributing data compared to participants who were using application with gamification, but with rewards not tied to the performance. Application without gamification received the least number of participation. Studies also showed that increased financial reward increased the quantity, but not the quality of the tasks (Mason and Watts 2009; Rogstadius et al. 2011). In fact, it was found that tasks are completed more accurately in non-profit crowdsourcing initiative (Rogstadius et al. 2011). It was also found that while the pay level (rate) does not significantly affect participation but, the compensation scheme does.

This study further emphasises the influence of financial incentive on users' participation in both, commercial and non-profit crowdsourcing. All of the 55 survey participants in this study are users of non-profit crowdsourcing applications, yet, finding shows that financial incentive is relevant and influential to them. This finding calls for a relook into the understanding of non-profit crowdsourcing as initiatives that do not reward their participants (Alam and Campbell 2012). In our opinion, and as far as users' participation is concerned, non-profit crowdsourcing should be able to reward the participants financially. However, what distinguishes commercial and non-profit crowdsourcing is that, the outcome or product of a non-profit crowdsourcing is not being commercialised for profit. This is similar to the definition of non-profit crowdsourcing adopted in (Rogstadius et al. 2011). The non-profit crowdsourcing example mentioned was a charity event where participants may still receive monetary reward for the work done, although the outcome of the crowdsourcing activities was for a non-profit reason.

## CONCLUSION

This paper presents about the design and development of a hybrid incentive mechanism for crowdsourcing applications that was developed based on users' preference. Two categories of incentives, financial and non-financial were included in the design. Users were found to be more active in contributing information using the prototype that implemented the hybrid incentive mechanism. Users' retention was also greater when using the prototype with incentive mechanism. This has proven the influence of incentive mechanism that suits users' pref-

erence in inducing greater number of participants in crowdsourcing initiatives. This finding contributes to the existing body of knowledge by adding more empirical evidence on the influence of incentive mechanism on users' participation. It can be improved by extending the duration of evaluation in the future. Besides, the number of participants can also be increased to obtain more representative results.

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