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Exploring the Process of Web-based Crowdsourcing Innovation

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ABSTRACT

Since the concepts of "customer innovation" (2002) and "crowdsourcing" (2006) were introduced, researchers have focused their attention on the phenomenon of crowdsourcing innovation. Relevant research includes the crowd's characteristics, the crowd's applicability in different phases of developing innovations, and instrumental aspects of web-based crowd innovation. However, there has been no research on how requesters leverage the crowd to effectively generate innovations, especially via information systems. In this research, to explore the value of information systems in leveraging crowdsourcing innovation under different conditions, I conducted and compared two case studies. After analyzing (I) an innovative idea collection software and (II) a StarCraft –related crowdsourcing project, four stages in the web-based crowdsourcing campaign were identified: (1) identifying, (2) requesting, (3) evaluating and (4) retaining the crowd.

Keywords

Web-based Crowdsourcing innovation, Case study, Information systems

INTRODUCTION

Researchers (e.g. Howe, 2006; von Hippel, 1986, 2002 a, 2002 b) have started focusing on whether the crowd, notably special *crowd-customers*, can be involved in innovation for the third parties. Also, the high interaction between firms and this specific crowd (e.g., Bateson, 2002; Brush and Artz, 1999; Mills and Morris, 1986; von Hippel, 1986, 2002 a, 2002 b) suggests more crowd-involvement in the production of services in service industry. In detail, prior research identified and discussed this crowd's characteristics, applicability in different phases of developing innovations (Gruner and Homburg, 2000), instrumental aspects of web-based crowd innovation (Reichwald, et al, 2004; von Hippel, 2002 a, 2002 b), correlation between the crowd's satisfaction, involvement in innovation development and organizational structure change towards crowd-driven innovation. Moreover, information systems have provided good platforms for crowd coordination and are widely used among innovation requesters.

Nevertheless, the question, how innovation requesters leverage crowdsourcing innovation via information systems, has yet to be clearly explained. With identified constructs in previous literature, I borrowed the hybrid approach used also by Kirsch (2004), which is consistent with Eisenhard's (1989) method and the Madill et al.'s (2000) arguments, in "a manner of grounded theorists" (Kirsch, 2004) to answer this research question. Thus, in the inductive paper using two qualitative case studies, I explored the interface between requesters and the crowd for web-based innovation crowdsourcing; this procedure involves actions taken by requesters and responses by the crowd for initial idea generation as well as

subsequent interactions.

The structure of this paper is as follows. The first part briefly describes the literature about web-based crowdsourcing innovation. The second indicates the research framework and discusses the blackbox in this framework. Aiming to illuminate the black box in the natural setting, the third part introduces the two case studies, followed by the result analysis. The final part of this paper is the conclusion and discussion.

CROWDSOURCING INNOVATION

Crowdsourcing, first used as a term by Howe (2006), is the act of outsourcing tasks traditionally performed by an employee or contractor, to an undefined, large group of people or community (i.e., a crowd), through an open call. Individuals in the crowd, sometimes, are slightly rewarded (e.g., in Mechanical Turk[1]). In this paper, I refer these tasks only to providing innovation or innovative ideas. With the increase of web applications' capabilities over the past two decades, the capabilities for crowdsourcing techniques have been greatly increased; now, the term often refers exclusively to web-based activity. Many innovation requesters, individuals or organizations, are using the crowd online for innovative ideas or innovation (e.g., formally written programming scripts). This phenomenon is described as crowdsourcing innovation in this paper.

Innovation requesters can either hire a 3rd –party information system vendor or design their own websites to connect with the crowd. For example, Mechanical Turk, 99designs, and CrowdSpring are online platforms designed by a third party for requesters to outsource tasks to the crowd. In contrast, Half Bakery, Threadless, ImagineCup by MicroSoft and IdeaStorm by Dell conducted crowdsourcing innovation through the website designed by the requesting company.

PRIOR RELEVANT LITERATURE

The rationale behind crowdsourcing innovation can be traced back to "customer innovation" (von Hippel, 2002a, 2002b) in management literature, where customers are regarded as a very special crowd. Two decades ago, researchers (e.g. von Hippel, 1986, 2002 a, 2002 b) started to focus on whether direct customer involvement in product innovation exists. The crowd, in addition to experts, is also a great source for innovation since crowd members are familiar with the product from their own consumption experiences. Moreover, researchers (e.g., Alonso, 2009, Kittur, 2008) and practitioners have both agreed that not only this special crowd (customers) but also the general crowd (whose members have more diversity) can generate innovative ideas or even real innovation (e.g., programming scripts), and they suggested practitioners take actions to leverage the crowd's wisdom. For example, a recent paper by Nambisan and Baron (2010) discusses how companies create virtual spaces to get customer input on product/service design.

Notably, researchers have been interested in the motivation of the crowd in web-based crowdsourcing innovation. For example, Hars and Ou (2001) examined the motivations of programmers contributing their effort to an open call for open-source softwares. These programmers' motivations can be identified as two general categories: internal factors (e.g., intrinsic motivation) and external rewards (e.g., direct or indirect monetary compensation, and recognition by others). Others (Xu, Jones and Shao, 2009) empirically supported that the reputation gained and skills learned from project participation may help the developer's future work opportunities. However, all of the above research mainly focused on

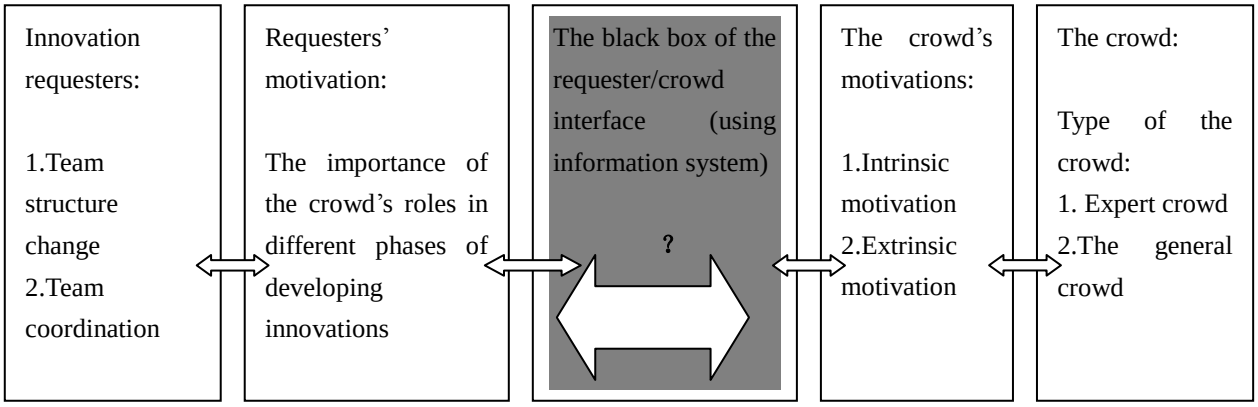
[1] Mechanical Turk is "one of the suites of Amazon Web Services, a crowdsourcing marketplace that enables computer programs to co-ordinate the use of human intelligence to perform tasks which computers are unable to do" (Wikipedia http://en.wikipedia.org/wiki/Amazon_Mechanical_Turk)

the intense crowd (the open source programmer community) and neglected the general crowd whose members have different backgrounds, relatively lower expertise and are normally loosely or not connected. In this study, to fully understand how the crowd interacts with the innovation requesters in web-based crowdsourcing, I re-examined the motivations of these two different types of crowds under in different scenarios. One scenario is about the general crowd submitting innovative ideas to requesters. The other is about an open-source programmer community/game players working on an IT task: to provide real innovation (e.g., programming scripts).

RESEARCH FRAMEWORK:

In this study, the main purpose is to explain the un-tapped black box of the interface between innovation requesters and the crowd (see Figure 1): the dynamics of interaction via information systems. Even if the characteristics (e.g. motivation) in other boxes have been described in prior literature, these characteristics were only discussed on a relatively small scale. For example, when discussing motivations of the crowd, the general crowd has been neglected. Thus, in the case studies, I also aim to verify the characteristics in the remaining boxes and systematically re-examine these characteristics. By integrating my exploratory findings and the confirmations of prior literature (Kirsch, 2004), I believe that the examination of the interaction (via information systems) will add great value to the burgeoning literature of crowdsourcing.

Figure 1. Research framework



METHODOLOGY

In this inductive research, based on the two different types of crowds (the general crowd and the expert crowd) indicated in Figure 1, I conducted and compared two case studies (Eisenhardt, 1989). Case one involves a university using a vendor's information system to collect innovative ideas from the general crowd of students. The other case describes a university research center asking a specific target group (programmers/video game players) via the center's own website to develop artificial intelligence applications in the context of StarCraft.

BACKGROUND OF THE CASES

Case I: University A in New Jersey hired one vendor of a crowdsourcing software, John and his team, and requested students to submit innovative ideas of how to improve students' experience on campus via a special idea evaluation system in this software. This system treats all the ideas as stocks and allows people to register to trade these ideas. This idea-market mechanism attracted 870 undergraduate students to vote on the 117 unique ideas submitted by students who

might also be the voters. Eventually, the student who provides the top idea can win an iPad. This crowdsourcing project started on November 1st, 2010 and ended on December 10th, 2010.

Case II: In order to test different tactics under the setting of StarCraft, a university research center in California asked StarCraft players with good programming skills to provide artificial intelligence scripts without gaining any monetary reward. Tom, the organizer, designed the website and forum, provided the instructions and the updates for the tournaments, and collected scripts from more than 20 participants. Some of the participants belong to other university research centers in the States. Others were open source programmers/StarCraft players, working individually or in teams. The project started in December, 2009 and ended in October, 2010.

SAMPLING AND DATA COLLECTION

To examine the designing, adoption and implementation of the information system in the two crowdsourcing campaigns, I intentionally interviewed eight people from both the organizing party and the participating party. These people included 2 website providers, 1 winning idea provider, 2 script providers, 1 regular idea provider who didn't win, 1 idea voter, and 1 script provider who didn't win. Interviews typically lasted for 30 to 45 minutes and were tape-recorded. According to the constructs explained in prior literature and the observation of the websites, twitter, emails, and Facebook, two guides were designed as uniform across cases to guide interviews. One guide was for innovation requesters and the other was for the crowd. The two guides were also semi-structured, aiming to trigger more self-report from interviewees. The descriptions of interviewees are shown in Table 1.

Interviewees	**Cases**	**Number of interviews**	**Forms of the interviews**	**Descriptions of the interviewees**
Tom*	StarCraft project (Case II)	1	Telephone	Organizer/website designer
Frank*	StarCraft project	2	Face-to-face	Winning script provider (Teamed with Prince)
Gabriel*	StarCraft project	1	Telephone	Failing at submitting the script
Prince*	StarCraft project	2	Face-to-face	Winning script provider (Teamed with Frank)
John*	University A (Case I)	1	Face-to-face	Vendor of the IS
Ike*	University A	1	Face-to-face	Idea provider who didn't win.
Jake*	University A	2	Face-to-face	Suggestion provider/idea trader
Andrew*	University A	2	Face-to-face	Winning idea provider

Table 1. Descriptions of Interviewees

Note: * The identities of all interviewees described in this paper have been camouflaged with fake names.

I conducted follow-up questions with four interviewees after I analyzed the transcription of the first-round interviews and the patterns shared in both cases (Carney, 1990; Miles and Huberman, 1994; Dube and Pare, 2003).

DATA ANALYSIS

I transcribed the interviews and wrote the fieldnotes while observing the documentation (Carney, 1990). Based on the

raw data and a coding scheme (Dube and Pare, 2003) as implied in Figure 1, I coded the transcription into several categories including the business process related to IS, motivations from innovation requesters, motivations from innovation providers, innovation requesters' feelings about this IS, innovation requesters' feelings about the crowdsourcing event, innovation providers' feelings about this IS, and innovation providers' feelings about this event. I presented the report summarizing what I found in both interviews and the documentation to the interviewees (Dube et al, 2003) and asked them for project reviews. My findings are demonstrated in the sequence described above. Figure 2 and 3 demonstrate in detail the processes of how the process of web-based crowdsourcing innovation has been implemented by innovation requesters. Figure 4 depicts a simplification of these processes.

Category # 1. Business process related to IS

Case I: University A:

As shown in Figure 2, University A outsourced the interface for innovative idea collection to one vendor: John. At the beginning, this university established a temporary task force. In the idea collection campaign, this task force consulted the student-and-faculty alliance to raise a topic of how to improve the students' experience on campus, hired a student team to advertise this campaign to all students on campus for more publicity, and offered an iPad to the winning idea provider. To better advertise this campaign, this student team designed and posted posters all across the campus; in addition, the vendor created a Facebook link. Due to the decreasing attendance rate of the crowd in the middle of the campaign, the vendor and the special task force organized a seminar, presenting slides about how to use this software and answering questions about the software's functionality to further advertise the campaign on campus. While monitoring students' activities and responding to students' questions and suggestions, the vendor added extra functions to this software, such as "*the expert check*" and "*water cooler*"(i.e., the communication function which is similar to a forum), and fixed the bug according to a student's suggestion via this system. At the end of this campaign, the best idea was selected and the idea provider won the iPad. Although the vendor wanted to do a survey to ask for students' opinions for using this system, the university didn't care much about examining it. John said in the interview: "*we are planning to conduct surveys for the feedback of using this system*", and he further added, "But *I don't think it's something the university would care*". For the next round of idea collection, vendor John also commented "*I think if the students see the university is serious about it and takes one or two of these ideas and really implements them, they will have a lot of intrinsic motivation to participate again*". This comment suggests that the organizing party didn't pay much effort in retaining students for the next round of crowdsourcing.

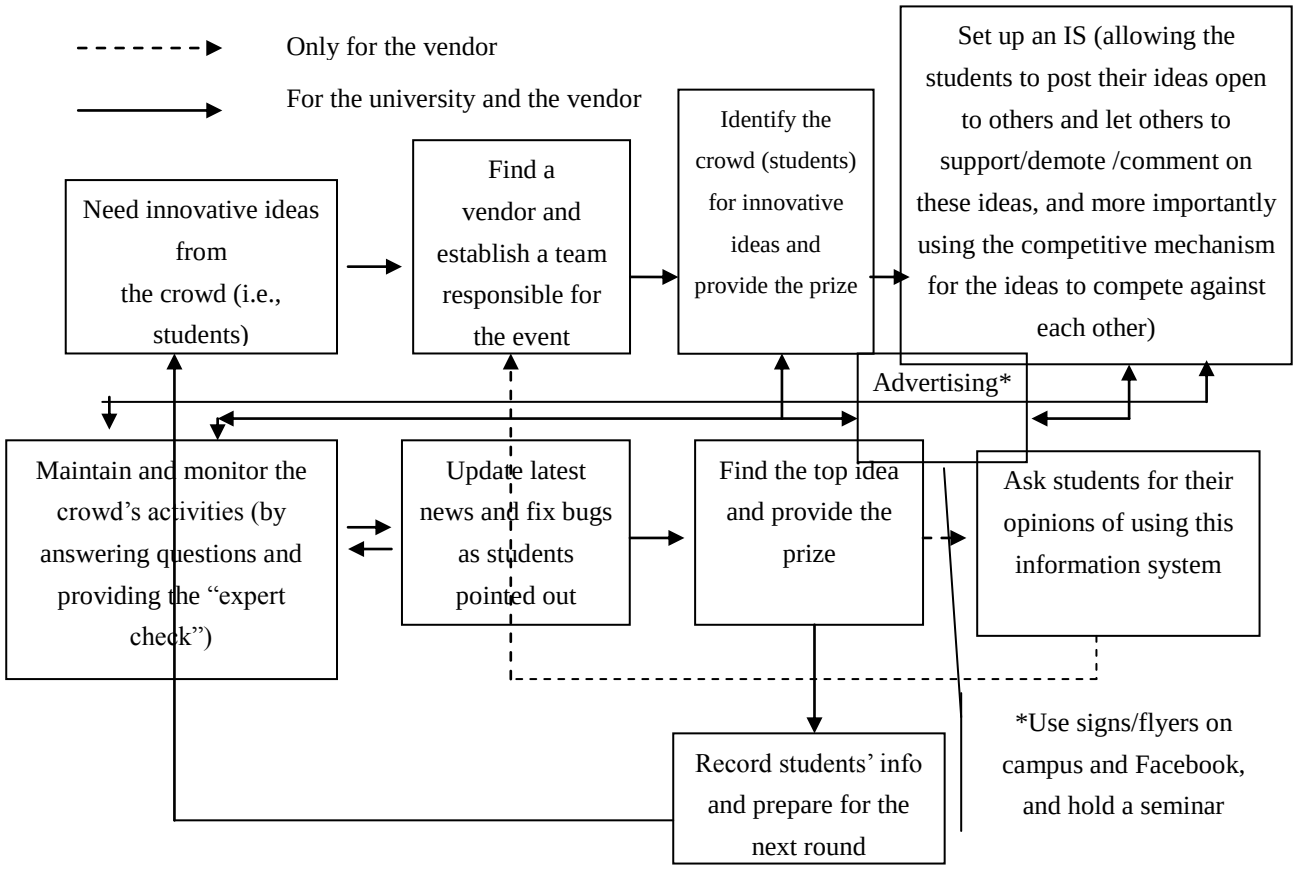


Figure 2. University A's business process of idea collection via the information system

Case II. StarCraft script requester

As demonstrated in Figure 3, at the preparation stage of the script collection event, the organizer, Tom, obtained the approval from Blizzard for using StarCraft as the context of the code competition and then designed the website as well as the attached forum accordingly. He posted an announcement about this event in a famous academic conference once and posted several other announcements in open source communities. Compared to the crowdsourcing campaign held by University A, the advertising in this event was less intense; moreover, the communication between Tom and the participants was less frequent either. Especially, Tom only provided technical instructions (such as what form of API to use) and rules for the programmers to comply to; then he communicated with the programmers in the forum about the campaign and questions they had. For instance, he said in the interview:" *I also used to set up forums where people can discuss about the competition so that the society as a whole can answer each other's questions rather than one person doing the whole thing.*" and "*I was the moderator. Not too much traffic. Not responding too much*." Via holding the four tournaments (i.e., each tournament represented one level of difficulty of competition), Tom identified three winners in the first three tournaments and invited the finalists in the fourth tournament to a famous academic conference to compete against each other. For the next round of innovation collection, he was confident that "*it makes sense to repeat it (this script collection event) along with conference*".

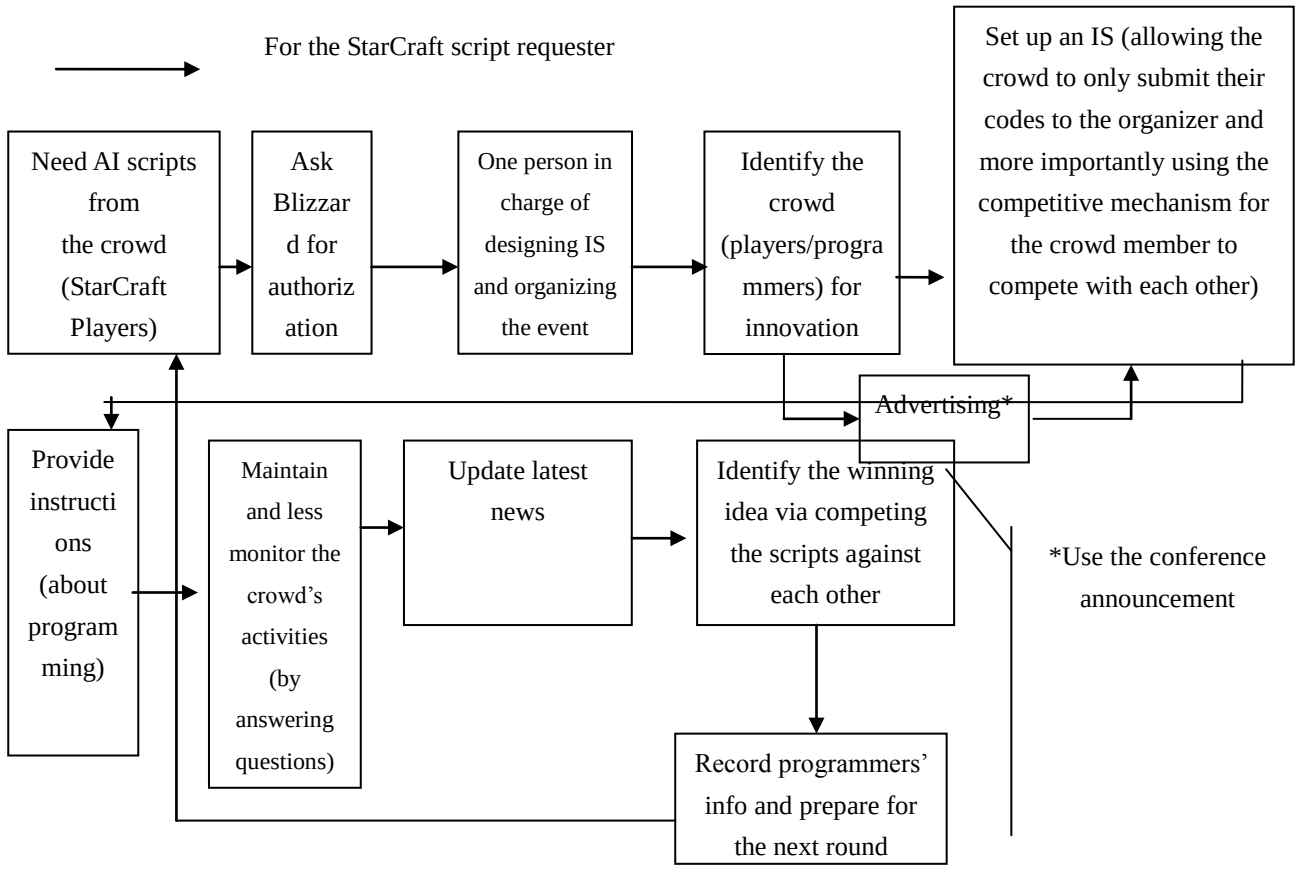


Figure 3. StarCraft script requester's business process of script collection via the information system

The simplified business process across both cases:

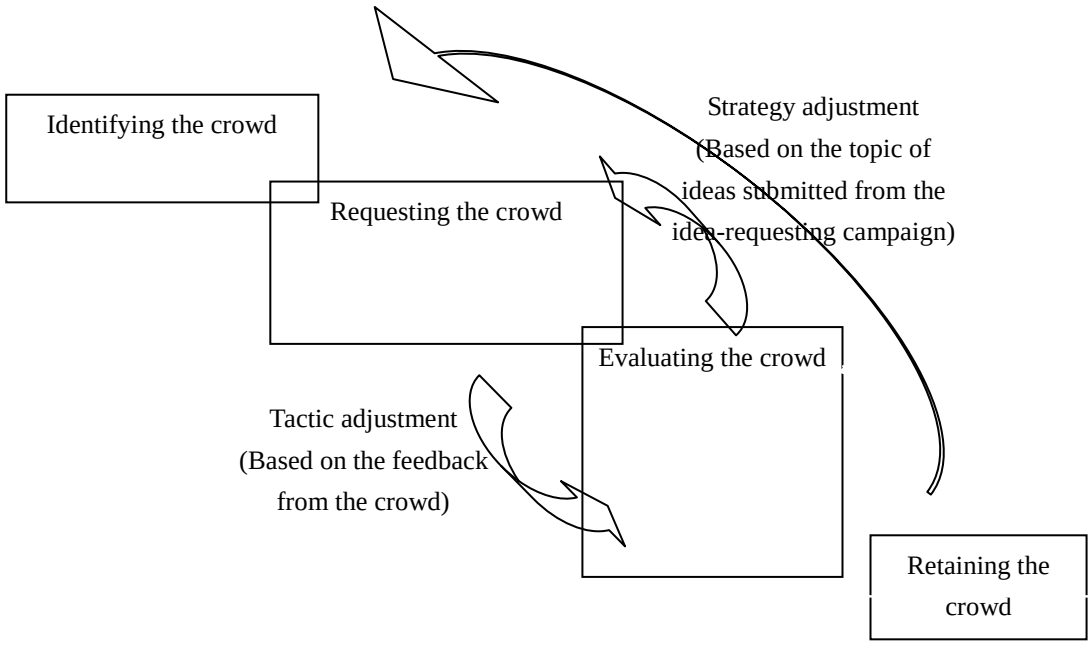


Figure 4. Conceptual flowchart for innovation requesters

By comparing the two cases, I conceptualized and simplified the business processes for innovation requesters into Figure

4. Four stages, which are identifying, requesting, evaluating and retaining the crowd, are acknowledged. This finding explains actions taken by innovation requesters.

Identifying the crowd:

Even before the events were held, organizers in both cases knew who they would outsource the innovative idea/innovation generation to. Thus they didn't spend much effort in this stage.

Tom (as the organizer) in case II said that "*I posted things around for players (of StarCraft) on the main StarCraft website. As it turns out, the programmers are intersection of people enthusiastic about programming and games.*"

John (as the vendor) in case I said that "*University A …wants to make itself better from students' ideas*"

Requesting the crowd:

Both organizers spent effort in finding the topic for crowdsourcing innovation and in advertising the events to the crowds. However, as implied above in Figure 2 and 3, the advertising in case I is more intense than that in case II.

Tom: "*I only posted things around for players on the main StarCraft website. As it turns out, the programmers are intersection of people enthusiastic about programming and games.*"

John: "*These are the undergraduate students who actually designed the whole marketing campaign and communicated with the students' community. They organized some sessions to introduce and talked with their friends about this. They hanged up posters and that's how we got awareness to the undergraduate students".*

Evaluating the crowd

Both organizers mainly focused on this stage. They first introduced the competition component embedded in information systems in the campaigns to encourage for better ideas or innovations and then adjusted the systems according to the feedback from the crowds. For example, Tom has experienced some problems when running one participant's submission.

Tom: "*So it's a team effort (of designing this website). In the lab and website, they(the team) did the format and I did the content context", "The rules are based on our competition on deciding what is allowed and based on professionalism" and "Some (problems) with running the submission (getting submissions on time), not with communications. One problem is that people tend to submit on the last day which leaves us no time to run tests on them and communicate to them (about) how their works are implemented. We're working on this for the future competitions*. *And one participant didn't get the chance to submit*".

John: "*Any ideas which got submitted become a stock market and anybody who has access to the system can have some play money, in our case, 2500 dollars. And they can use that to buy shares which they think are the best ideas. Then after a while, you see some ideas got a very high share price. The crowd would think that this is the best idea or the idea which would have the highest chance to get selected. Because our rewards in this system define these ideas which are most likely to be selected by our university, this is the principle of idea markets*" and "*By the expert rating we added later(showing me the system), we basically know if the idea is on or off the topic*.".

Retaining the crowd:

Both organizers showed their attention in informing the current crowd of the next-round crowdsourcing campaign. But neither of them made sufficient effort in encouraging them to attend.

Tom: "*Next year, people will just spent time on improving their work. Although some of the work is impressive, there are still explorations which could be done with Bots. So it makes sense to repeat it along with conference*."

John: "*I think if the students see the university is serious about it and take one or two of these ideas and really implement them. I think they will have a lot of intrinsic motivation to participate again*"

In summary, in Figure 4, the various sizes of boxes represent the differing levels of efforts spent in different phases. Both innovation requesters emphasized the third phase and underestimated the fourth one.

Moreover, innovation requesters' tactic adjustment occurred between the second and third phases. In other words, in both cases, the organizers changed the information systems and the ways to advertise the innovation/innovative idea collection campaigns according to the feedback from the crowds. An example can be:

John said "*There are two computer science students who are almost professional hackers. ….They did the program and found a way to hack into our software. But they didn't abuse that and instead they let me notice that 'hey there is a little security breach in your system'. So they helped me fix that.*"

When the topic of the idea-requesting campaign changed, strategy adjustment also happened from the fourth to the first stage. Evidence can be found in:

John said "*the topic of the ideas from students is from the student alliance*." and *"Meanwhile, here is the faculty market (which uses faculty not the students for idea collection). And it's growing there*".

In order to investigate responses by the crowd for initial idea generation as well as subsequent interactions, motivations of requesters and the crowd and these two parties' feelings about the crowdsourcing campaigns both need to be examined. The relevant findings are as follows.

Category # 2. The motivation of requesters:

In Case I, the motivation was to improve the university; in Case II, the motivation was to test different tactics in the context of StarCraft.

Category # 3. The motivation of the crowd:

In order to evaluate and better design the information systems in the crowdsourcing setting, the motivation of the crowd needs to be examined; the following table lists the findings of the crowd's motivation. In these findings, I confirmed some motivations already discussed in prior literature, and identified some new ones.

Motivations shared in both cases	**Motivation unique to each case**

Peer recognition (Confirmed: in both cases)	Learning new skills (Confirmed: only in AI project)
Be the "winner" (New: in both cases)	Helping to improve an organization (New: only in University A)
Lack of desire for monetary prize (New: in both cases)	
Lack of desire for pursuing Intellectual Property rights (New: in both cases)	

Table 2. Motivations of the crowd

For example, I noticed that in both cases the crowd members think of winning or competing against others as very important factors to participate. In terms of skills or knowledge, they were well prepared before the event started. Examples (see Table 2) are:

Andrew (from Case I): "*This would bring a little competition every day to campus. I don't have any problems with that. It gives us a little something we can chat up on. I think it's a good idea*" and "*I've been doing some research and some reading on the side very several weeks before this event started.*"

Ike (from Case I): "*Hopefully as the campaign is coming to the end and more people are dragged into this (my idea), the number (of votes) would be lifted*." and "*The research I did is that I verified if my idea was correct. I went to the classrooms again and made sure that there is no clock in the classrooms. And also I pulled my friends aside and asked: do you think this is a good idea, before I submitted.*"

Another surprising finding suggests that the crowds from both cases would submit innovative ideas or innovations without monetary awards as long as their works were recognized.

I asked a question in the interview: "*if the requesters didn't give you the open system (the crowdsourcing software) and people didn't know your credit, how would you react?*" Andrew (from Case I): "*I probably will get angry." Also he said: "I still want to do it (participating in the crowdsourcing project) without any reward. I even didn't know that there is an iPad, you know after I got to number one.*"

I also recognized that some motivations depend on whether the topic is about providing actual innovations. For example, participants in Case II care more about their learning process. Frank said "*If I can learn something, I will do it.*" Moreover, I found that the crowds in both cases don't care about the rewards. Andrew (as the winning-idea provider) in Case I even said "*I even didn't know that there is an iPad, you know, after I got to number one.*"

Considering that innovation and innovative ideas submitted to a third party might trigger intellectual right issues, I asked a relevant question in the interviews. To my surprise, none of the crowd in both cases showed any concern on this. For example, Andrew said: "*I physically think that I would put a pass to someone who takes an idea and puts in action.*" and "*even if I didn't get the credit for giving the idea, people would stop me as I walk on campus and they would realize that I created the idea*."

Categories # 4-7 The Feedback from both the innovation requesters and the crowd

I found that although problems do exist (e.g., the submission problem in Case II and the bug in Case I), both innovation requesters and the crowds are satisfied with the most of parts about the events and the information systems (see Table 3),

From innovation requesters:	**From the crowd**
University A case:	University A case
About IS: *"This software can be applied to anything. Anytime, people say that we have a problem and want ideas and we want the ideas from the crowd to solve this problem "* and *"So I think this makes more people to participate. "* from John	About IS: *"I think it's great, very intuitive and interesting."* from Andrew; *"Without the system,I think it would be harder for students to submit ideas to the school"* from Chris
About the event: *"Its 800 and plus people. And only 117 ideas. So less than 1/4 people is actually submitting ideas. There are more than 1100 comments. "* and *"So far the communication works very well …Not all good but there are some really good ideas about how the universitie could become better. So I think if a few of these ideas are implemented, you would really see a different university. So that is good. "* from John	About the event: *"it seems like very interesting. It gets people more involved than letting people write what could be good and then dropping in the mailbox"* from Andrew; *"I think it's a good way and an easy way for students to get recognized for their ideas. It really enourages students to change activities on campus."* from Chris
AI Project case	AI Project case:
About IS: N/A	About IS: *"It serves the purpose. I mean. ", "I am impressed that it was designed by one person. It's so much work".* and *"everything that needs to be. "* from Frank
About the event: *"20 emais weekly and then more. Not too many submissions but more than anticipated. ", "the winning submission was very interesting. I would say they (the participants) are qualified "*. and *"There were a lot of submissions this year* (2010) *and it was pretty successful."* from Tom	About the event: *"that* (the event) *is more for fun than anything else…And if we can make something out of it. That can be very interesting. ", "It was awesome most because we learned a lot of things that we didn't know before. It's a little bit practical experience with AI. But we didn't expect to win".* from Frank

Table 3. The feedback from both the innovation requesters and the crowd

CONCLUSION AND DISCUSSION

After the data analysis, the black box indicated in Figure 1 can be explained as seen in Figure 5. For innovation requesters, four stages of interacting with the crowd via information systems were identified as shown in the middle box in Figure 5: identifying, requesting, evaluating, and retaining the crowd. Moreover, the characteristics in the remaining boxes were confirmed.

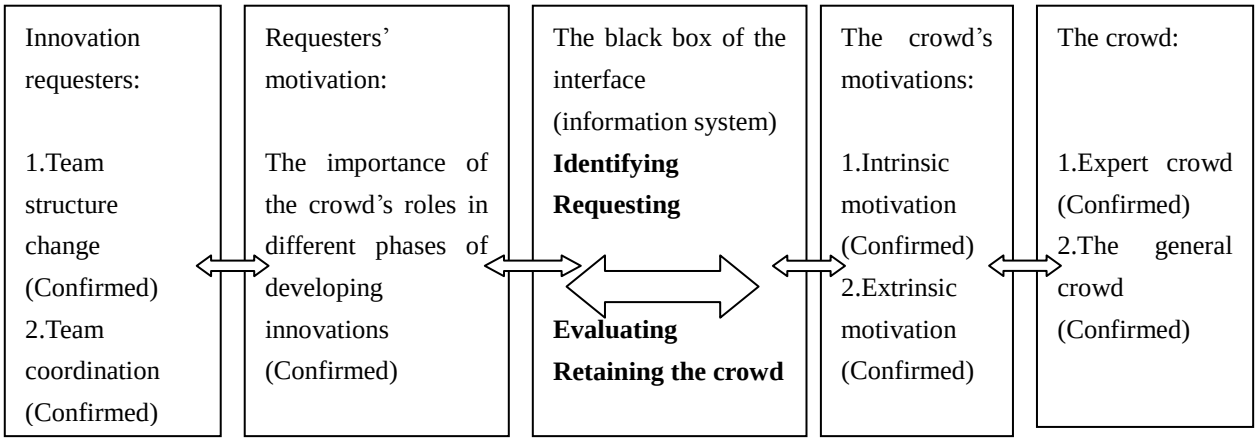


Figure 5. Research framework with the theoretical gap being filled

Limitation

Although the two crowds for the case studies were different, the general crowd studied in this research was a collection of students. Theoretically, students cannot represent the general crowd because (1) they are similar, and (2) they all have had campus experiences where expertise can come from. The ideal case for the general crowd should involve crowd members who normally have diverse backgrounds and low expertise (e.g., turkers in Mechanical Turk). However, in practice, it's difficult to get access to innovation requesters who request the ideal general crowd for innovation. Hopefully, in the future, researchers can study the ideal-general-crowd-involved crowdsourcing project and be able to find the significant difference between this project and the project involving the expertise-intensive crowd (e.g., programmers' community).

Implication

Aiming to explain the un-tapped process of crowdsourcing innovation, this research identifies four stages in this process, discovers some motivations of both innovation requesters and the crowd and confirms some from the prior literature. Especially, the crowd's various motivations can trigger different performances. In order to fully encourage the crowd to participate in the crowdsourcing project, I suggest practitioners take strategies and balance out the effort across the four stages (as described in Figure 6). Especially, practitioners need to focus more on the first stage (identifying the crowd) and the last one (retaining the crowd). This implication suggests the best way to leverage crowdsourcing innovation via information systems.

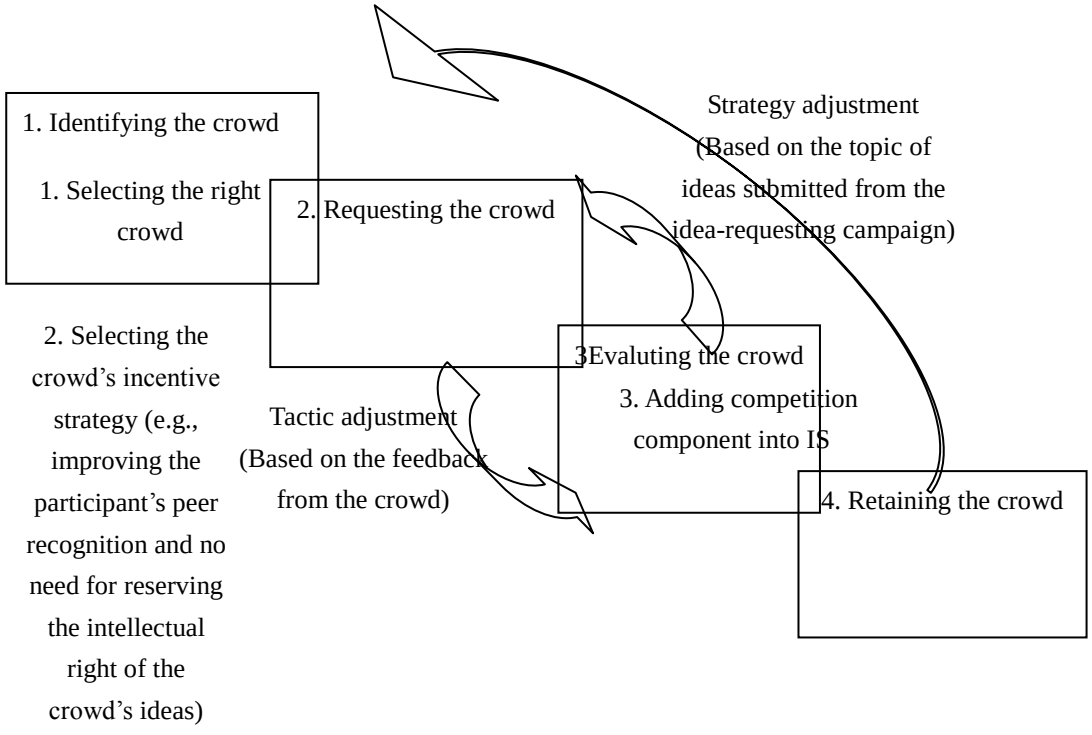


Figure 6. Conceptual flowchart for innovation requesters with suggested strategies (Note: the sizes of the boxes represent the suggested efforts across the four stages)

As an exploratory effort, this paper attempts to illuminate the black box of the ways in which innovation requesters leverage web-based crowdsourcing innovation via information systems. With the purpose of solving the complexity of the relationship among the innovation type, the crowd type, the information system and the innovation requesters, four stages of using information systems to crowd-source were identified. I believe my research on the interface between innovation requesters and the crowd would add value to the burgeoning literature of crowdsourcing.

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