A Methodological Framework for Crowdsourcing in Research

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Abstract

The adaptation of crowdsourcing from commercial marketing in the private sector for use to support the research process is increasing, providing investigators a wealth of case studies from which to discern emerging best practices. The successes and failures of crowdsourced research have not yet been analyzed to provide guidance for those interested in these new methods, nor have these data been synthesized to yield a methodological framework. This paper provides an evidence-informed methodological framework that describes a set of concepts, assumptions, and practices to support investigators with an interest in conducting crowdsourced research.

Our case studies cover the different phases of the research lifecycle, beginning in the research design phase by examining open innovation challenges, moving to the implementation phase of crowdsourced cognitive interview data collection, and concluding with supplemental data collection. Successful implementations of crowdsourcing require that researchers consider a number of dimensions, including clearly articulated research goals, determination of the type of crowdsourcing to use (e.g. open innovation challenge or microtask labor), identification of the target audience, an assessment of the factors that motivate an individual within a crowd, and the determination of where to apply crowdsourcing results in the overall research lifecycle. Without a guiding framework and process, investigators risk unsuccessful implementation of crowdsourced research activities. The purpose of this paper is to provide recommendations toward a more standardized use of crowdsourcing methods to support conducting research.

Introduction

Crowdsourcing has rapidly grown with the proliferation of the internet which has enabled likeminded individuals in society to become increasingly connected with one another. The term originated in a Wired Magazine article by Jeff Howe (2006) in which he described the emerging phenomenon as, "outsourcing to a large crowd of people." Since then the term has evolved and been defined in a variety of ways. King (2009) described crowdsourcing as, "tapping into the collective intelligence of the public to complete a task." Key characteristics of crowdsourcing are that it is a voluntary and participative online activity, crowdsourcing tasks can be of variable complexity and modularity, and it must be mutually beneficial to the crowd and the activity sponsors (Estellés-Arolas and González-Ladrón-de-Guevara, 2012).

In recent years, researchers have increasingly used crowdsourcing methods throughout the research lifecycle with varying degrees of success (a. Keating et al., 2013; b. Keating et al., 2013). Such innovative approaches have yielded encouraging results; however, there is a paucity of literature on crowdsourcing methods, which may limit investigators' ability to replicate successful interventions. In the absence of a guiding framework to help researchers design successful approaches to crowdsourcing in research, the methods represent a higher-risk, trial and error proposition. This paper aims to address this gap by providing a modifiable framework for crowdsourcing research and provides a model for inducing individual participation in such activities. We use a variety of case studies, specific to survey research, to illustrate the application of this framework.

Alignment in the Components of Crowdsourcing

Before beginning any crowdsourcing activity, researchers need to consider the components of crowdsourcing, each of which plays an integral part in the success of the approach. These components include understanding the research goal, the audience, the engagement mechanism, the platform, and the sensemaking approach, shown in **Figure 1**. There is a flow to developing these components that begins with the research goal.

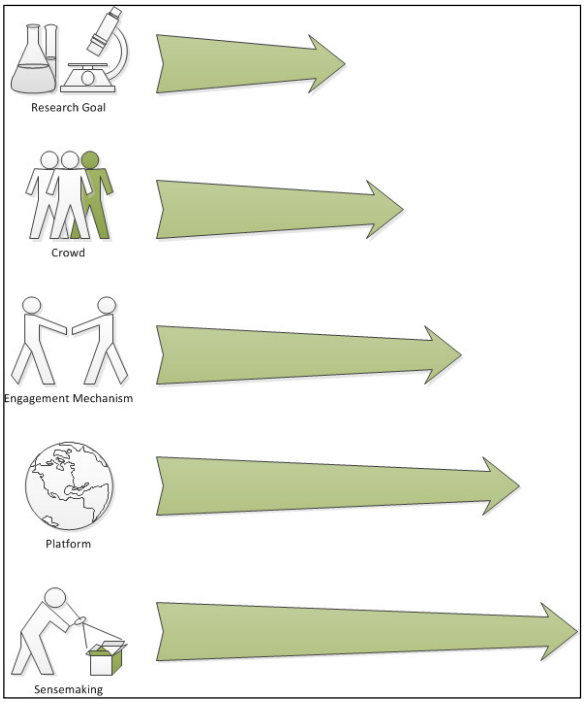

Figure 1. Components of Crowdsourcing in Research

Establish the Goal of the Research

The research goal is the first component that should be established by an investigator as they consider crowdsourcing. Clearly articulating the aim of the crowdsourcing initiative before beginning should be considered best practice. As with any goal, we recommend that the goal be concrete, specific, and measurable. By crafting goals with these attributes, the investigator can determine whether or not the approach was successful.

Define the Target Audience

Once the research goal is established, the audience required to achieve this goal can be defined. Researchers must know their crowd. Depending upon the research goal, specific audience segments may need to be targeted. For example, if the goal is to determine the mail return rates from the United States Census, then researchers will need to target individuals capable of contributing data required to conduct this sort of analysis (e.g., data scientists). Alternatively, if the goal is to collect photographic data on tobacco product placement in retail locations, then researchers will need to target individuals who are willing to do such tasks (e.g., city dwellers who own smartphones and are engaged adequately to visit a variety of stores).

Identify Suitable Engagement Mechanisms

Knowing the audience will help the research team target recruiting and participation in the crowdsourcing event and inform the crafting of an effective engagement mechanism. This mechanism should be designed to appeal to the likely motivations of individuals within the crowd, encouraging them to take part in the crowdsourcing activities. This is one of the most important steps in the planning process. We have further developed a method for crafting effective engagement mechanisms by extending a simple yet powerful behavioral framework which we discuss in the next section of the paper.

Determine a Technical Platform to Support Activities

A suitable platform to support the crowdsourcing activities is identified after the researcher has defined the target audience and designed an engagement mechanism. This platform provides a forum for communicating and exchanging value with participants. Selection criteria for a crowdsourcing platform should include the availability of the resource to members of the target audience, the ability to integrate relevant engagement mechanisms to drive ongoing participation, and the means to distribute incentives after completion of the activities.

The diversity of crowdsourcing platforms available on the market is growing exponentially, giving researchers a tremendous amount of options (visit http://www.crowdsourcing.org/directory for information about potential

crowdsourcing platform options). Depending upon the crowdsourcing event, researchers can even create their own platform for their crowdsourcing event and we discuss a couple of examples below in Case Studies 1 and 2.

Inventory Data Quality Standards

Finally, investigators should define standards to characterize useable data, or other crowdsourced returns, that can be applied toward satisfying the research goal. Ensuring that there is alignment between the incoming data from a target audience and the research goals will increase the likelihood that these goals will be achieved.

The Motive-Incentive-Activation-Behavior Model of Crowdsourcing

"Most of economics can be summarized in four words: 'People respond to incentives.'
The rest is commentary." – Steven E. Landsburg

Participation in crowdsourcing activities is driven by the motives of the individual. In particular situations, incentives can and should be used to activate an individual's motivations, enabling a specific behavior, such as taking the time required to contribute to a crowdsourced research activity. Understanding how motivations can be influenced and activated through intrinsic and extrinsic incentive pathways is a critical aspect of designing effective crowdsourced interventions. Rosenstiel (2007) provides a simple model to describe the activation of human behavior on the basis of motive-incentive-activation-behavior, or MIAB, which we show in **Figure 2**.

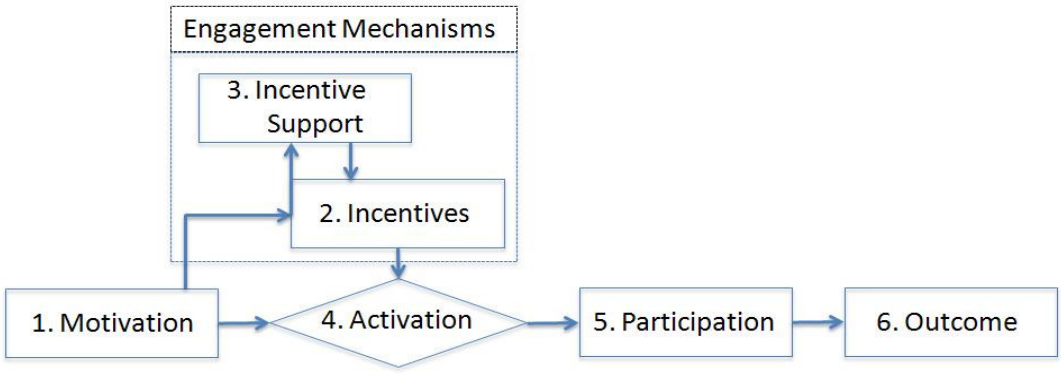

Figure 2. The Motive-Incentive-Activation-Behavior Model of Crowdsourcing

The components of Motivation and Incentive are tightly linked and represent the two fundamental mechanisms for engaging prospective participants in crowdsourcing. The term "motivation" is defined in the Oxford English Dictionary as the reason or reasons one has for acting or behaving in a particular way while an "incentive" is defined as a thing that motivates or encourages one to do something. Both intrinsic and extrinsic motivational factors may play a role in an individual's decision to participate and are important considerations in the intervention design phase.

Self-Determination Theory (Deci & Ryan, 1985) distinguishes a difference between two different types of motivation that result in a given action. Intrinsic motivation refers to doing something on the merit of pleasure or fulfillment that is initiated without obvious external incentives. External motivation is activated by external incentives, such as direct or indirect monetary compensation or recognition by others.

Several authors have revealed motives that explain the motivation of participation in open source projects (Hars, 2002; Hertel, 2003; Lakhani, 2003; Lerner, 2002). Applied to crowdsourcing, intrinsic motivators could stem from an individual's inborn desire and feelings of competence, satisfaction, and enjoyment while the potential to win a prize for participation may act as an external incentive (Leimeister, 2009). Extrinsic activated motivates can be further divided into two classes: direct compensation and social motives (Vallerand, 1998). Monetary or non-

monetary awards, including trophies, medals, or other prizes are examples of direct compensation. Social motives include the expected reaction of individuals whose opinion is valued by the participant, such as friends, partners, or audience members. Motivation to participate in competitions is greater if members of an individual's social network indicate the importance of participating in an event. Within survey research, leverage-salience theory argues that community involvement in a study has positive effect on individual cooperation and participation (Groves et al., 2000). As applied to crowdsourcing, participants may expect positive reactions from other participants, organizers, or beneficiaries of the activity.

The concept of Activation addresses an individual's decision to initiate a behavior. Of concern in the area of activation is the persistence of this state, or the application of continued effort toward achieving a specific goal. Thus, consideration of incorporating activation-supporting components is an additional factor for consideration in the design of crowdsourcing activities. Examples of activation-supporting components may include providing participants with access to the knowledge of experts for inspiration and reference throughout the activation phase. Alternatives to expert knowledge include providing mentorship to participants or supporting an open community and exchange of knowledge within the network of participants.

The term "behavior" is defined by the Oxford English Dictionary as the way in which one acts or conducts oneself. In the context of crowdsourcing activities, there are various behaviors that may be considered desirable outcomes, including original content generation, providing support or collaboration within a network of contributors, or other constitutive components required to devise a specific solution.

The MIAB model provides investigators considering the use of crowdsourcing methods to support research activities with a high-level roadmap of considerations that must be addressed in the design phase of the intervention to ensure successful engagement with participants. Additionally, if things do not go as planned this model can provide a way to diagnose the causes of the problem and to craft the solution. We will discuss two such examples in the case studies below.

Case Study 1: RTI's 2012 Research Challenge

In 2012 RTI International was in the process of planning for an upcoming omnibus survey. During the questionnaire design phase the decision was made to experiment with the potentials of creating a crowdsourced instrument. To complete this task we launched the RTI 2012 Research Challenge.

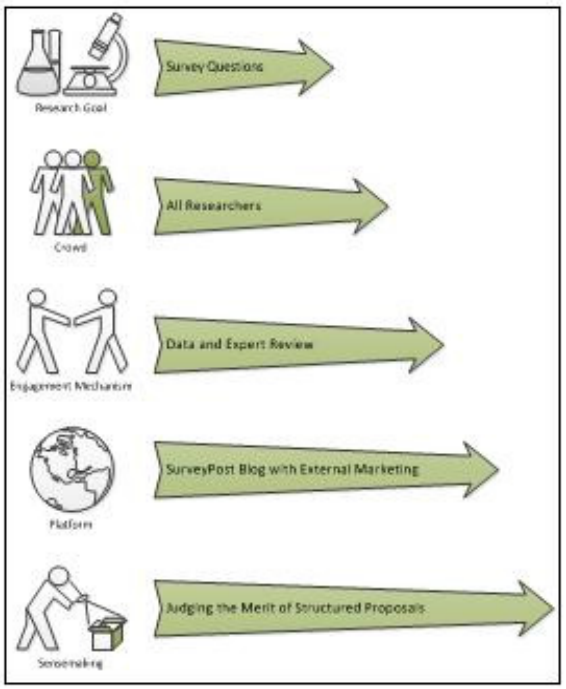

Figure 3: Crowdsourcing Components of RTI's 2012 Research Challenge

The goal of this challenge was to create high quality survey questions for the upcoming study. We targeted the researcher crowd at large, asking for all ideas. To engage the crowd we used a combination of incentives to appeal to extrinsic motivations. First, participants were told that if they won the competition then they would receive the response data to their survey questions, demographic data and exclusive publishing rights for one year after data delivery. Second, the judges were well known in the research community, particularly survey research, giving young researchers the opportunity to get their work in front of leaders in the field. RTI created its own platform for the event, and used a web form on its SurveyPost blog to receive entries and publish information about the event. RTI staff also did heavy marketing on professional listservs, like AAPORnet, to get the word out about the event. We created specific submission criteria for the event to ensure that sensemaking would be relatively easy for the judges. We asked researchers to submit a two page synopsis of their research idea and up to ten survey questions.

This event was very successful and RTI received 76 entries in 23 days. Topics ranged from questions about emerging tobacco products to astrological theories about how people meet their mates. Participants in the event ranged from undergraduate students to deans of well-known universities. In the end, the omnibus survey had plenty

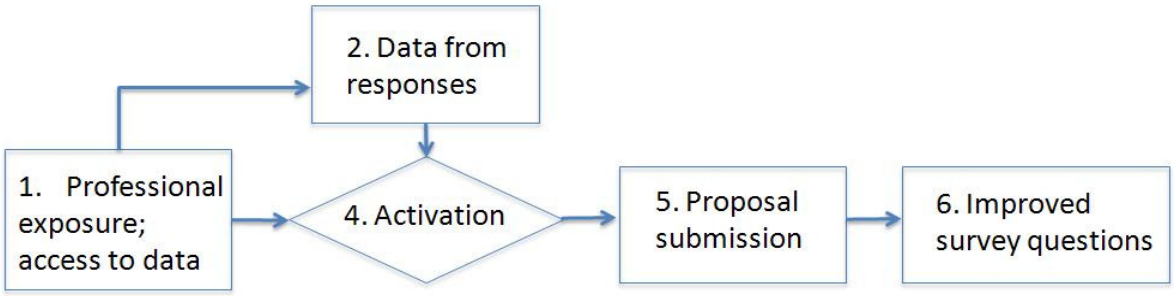

Figure 4: Applying the MIAB model to the 2012 Research Challenge

The MIAB model can help identify some of the reasons why this event may have been successful. Advancing a research agenda through professional exposure is a motive for many researchers. Gathering data that can be used for conference presentations and publications can help to advance a research agenda and thus acts as a good incentive for these researchers. After considering the possibilities, researchers activated and submitted a proposal to the research challenge. By doing this, they did the intended behavior, giving RTI's study a good set of survey questions for the upcoming study.

Case Study 2: Crowdsourcing Cognitive Interviewing Recruitment on Facebook

Not everything always goes according to plan when crowdsourcing, and we have found value in using the MIAB model to help diagnose the sources of problems in our crowdsourcing approaches. Such a case arose recently as RTI pilot tested the use of crowdsourcing methods to collect large quantities of cognitive interview response data on Facebook. The goal of this study was to determine if we could collect large quantities of useful cognitive interview data using Facebook as a recruitment tool. We used targeted advertisements that were shown to a crowd of Facebook users who liked music. To engage the crowd we offered a $5 music gift card to appeal to these users' extrinsic motivations to acquire more music. RTI created its own platform for the event, and used Facebook to broadcast the event and a Web survey to receive the data. The Web survey was highly structured to ensure that sensemaking could be done in datasets by researchers.

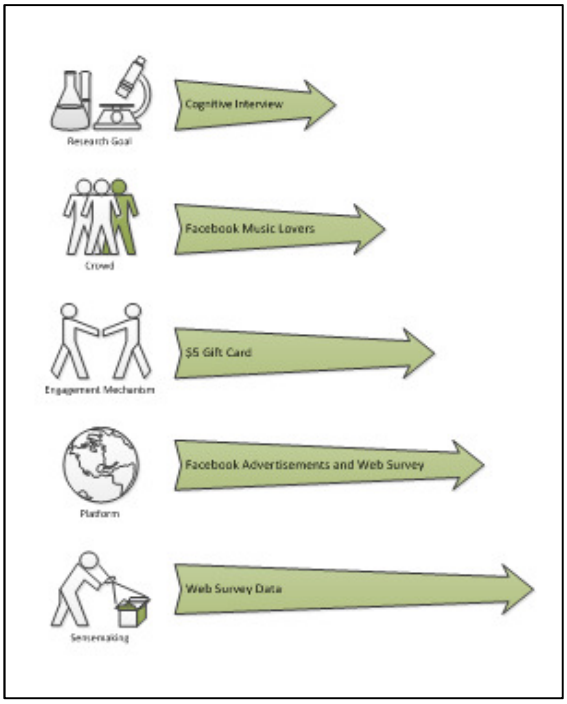

Figure 5. Crowdsourcing Components of Cognitive Interview Recruitment on Facebook

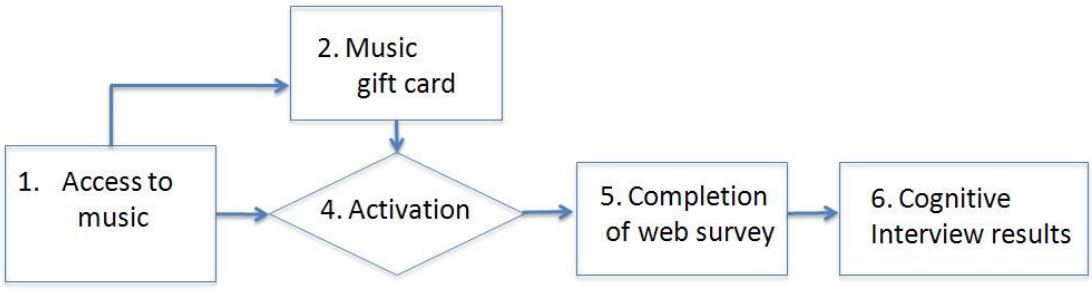

Figure 6. Applying the MIAB Model to Cognitive Interview Recruitment on Facebook

One of our assumptions in designing this recruitment approach was that music lovers were motivated to acquire more music. As a result, we offered the $5 music gift card incentive to appeal to these motivations and encourage activation and participation in the event. Unfortunately, this incentive was not great enough to lead to participation and after a few days we focused on an alternative approach.

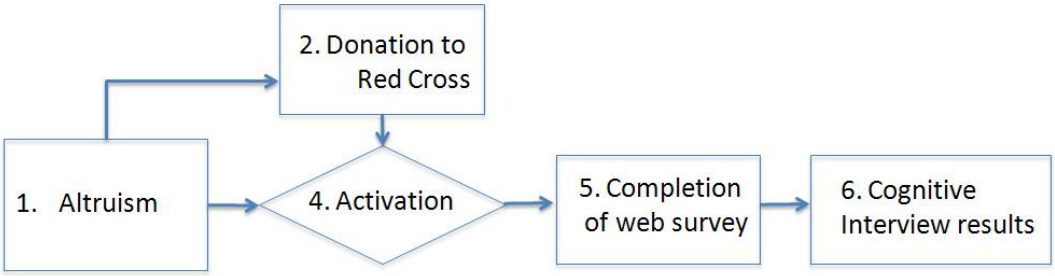

Figure 7: Applying the MIAB Model to a Modified Cognitive Interview Recruitment Approach

In our modified approach we targeted a crowd of Facebook users who liked the American Red Cross. Our thought process was that people who like the American Red Cross will be motivated by altruistic causes. As a result, we used a $5 donation to the American Red Cross as an incentive for people to participate. This was successful in leading these Facebook users to make the decision to activate and take the Web survey. This was our intended behavior and led to the creation of a large volume of useful cognitive interview data.

Case Study 3: Collecting Tobacco Retailer Data on Snus in Chicago

One of the most exciting aspects of crowdsourcing is the ability to collect large quantities of data quickly and relatively cheaply. This can be done in the data collection phase of a project by collecting supplemental datasets that add depth to traditional survey data. For example, if a survey is collecting data on the demand side dynamics snus tobacco, then it would also be useful to also know where the local snus supply is. In 2012 RTI experimented with an approach to collect fine level tobacco supply data from retailers in Chicago.

The goal of this study was to rapidly collect large quantities of local retailer data about snus tobacco. Given the large quantities of retail locations that needed to be called and the short duration of these tasks, we used the crowd of microtask workers on Amazon Mechanical Turk. To engage the crowd we offered a $0.75 reward if the worker called a retail location to ask if it sold snus tobacco. We used the Amazon Mechanical Turk crowdsourcing platform to manage the data collection and pay workers.
Sensemaking was simple since the response data was neatly organized in a spreadsheet and could be easily matched to retailer address data.

The MIAB model can help to identify some of the reasons why this approach may have been successful. Workers who use Amazon Mechanical Turk are generally motivated to make money by working jobs posted on the platform. When compared to other jobs posted on the platform, our research team offered a relatively generous incentive for the workers who chose to complete our tasks. This led to fast activation. We made data entry easy and straightforward in our job postings, so that data was captured accurately.

During the initial phases of data collection we found that some workers were not doing the intended behavior when they collected tobacco data from retailers. These workers were including other smokeless tobacco products, like dip or chewing tobacco, in their results. We did not want data about these other tobacco products and clarified the instructions in our job postings. This proved to be a quick solution to the problem, and it is one more example of how the MIAB model offers a quick method for researchers to identify where tweaks may be needed to their crowdsourcing approach.

Figure 8: Crowdsourcing Components of Tobacco Retailer Data Collection

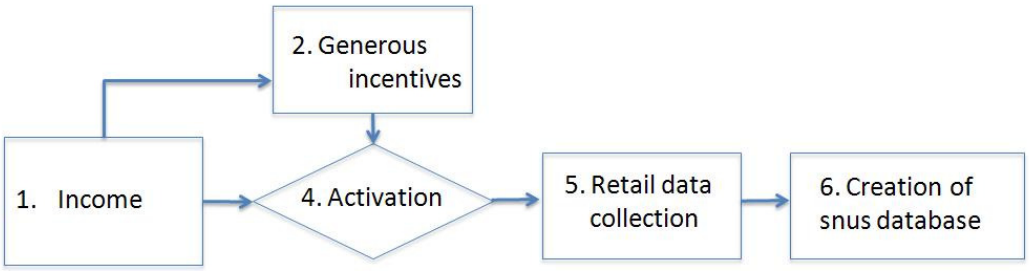

Figure 9: Applying the MIAB Model to Tobacco Retailer Data Collection

In the end we collected data from retailers quickly and effectively, which holds promise for implementing this sort of rapid supplemental data collection approach on outgoing studies.

Conclusions

Crowdsourcing holds promise as a means for researchers to achieve new and ambitious research goals; however, without a guiding methodological framework, researchers run the risk of being unsuccessful in their crowdsourcing endeavors.

Before taking a crowdsourced approach, we encourage researchers to consider and define the components of crowdsourcing for the project, all of which flow somewhat naturally from one another. Begin with a goal. This goal will help the researcher determine who can help achieve that goal. Knowing who will participate will help to choose the appropriate mechanism to encourage engagement. This mechanism may dictate what platform should be used for the crowdsourcing event. This platform will guide what sort of data will come back from the crowd.

As the researcher plans their engagement mechanism, they should use the MIAB model to guide this process. Incentives should appeal to the motives of the crowd. Only when motives and incentives are aligned will activation occur. Once activation occurs, researchers should consider activation supporting mechanisms. Monitoring the behavior of participants is also encouraged. As our case studies showed, sometimes tweaks will need to be made to ensure the researcher gets the proper data back to achieve their goals.

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