

A Crowdsourcing Practices Framework for Public Scientific Research Funding Agencies

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1. BACKGROUND

Scientific research and the work of public scientific research funding agencies (SRFAs) has in recent times been impeded by various obstacles and challenges. SRFAs are predominantly engaged in tasks surrounding the assessment and funding of scientific projects through research call processes. Such traditional processes face various problems. Firstly, scientific research in recent years has seen increased competition between participants for decreasing resources globally. Added competition and submissions brings a new layer of complexity to existing processes. Secondly, it is difficult to build and assess multidisciplinary and trans-disciplinary research projects through existing approaches. Thirdly, existing call assessment / peer review processes have shown intellectual insularity, a lack of flexibility and a lack of transparency in project selection mechanisms. It is posited that crowdsourcing presents solutions to many of these challenges. Whereas research has seen the advancement of various crowdsourcing models and taxonomies it is posited that many of these do not suit the specific needs of SRFAs. A practical contribution is required whereby practices are advanced to assist task completion by SRFAs in research assessment and funding processes. Open collaboration presents as a means to enable SRFAs. Accordingly, this research proposes adapting an exemplary crowdsourcing framework for selecting, formulating and evaluating crowdsourcing practices for use by public SRFAs.

Categories and Subject Descriptors

H.4.3 [Information Systems Applications]: Communications Applications.

General Terms

Performance, Design.

Keywords

Crowdsourcing, framework, practices.

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1.1 SRFAs

Historically, the funding and instantiation of scientific research was conducted by different means. Through the 19th and 20th centuries many scientific discoveries were made by individual scientists or early industrialists working in labs. As the 20th Century progressed the emphasis switched to the development of academic and private sector research initiatives with such research been sponsored by companies and governments. More recently new forms of research funding and construction have become evident with sponsorship and management coming from a variety of combined/differing sources including the third sector. As one such actor in the landscape public SRFAs play an important role in developed societies. They are known by a series of terms that vary between jurisdictions including research agencies, research councils and research hubs. For the purposes of this research the term scientific research funding agency is adopted for the purposes of clarity. From the study of literature across domains public SRFAs are engaged in several tasks including (i) Implementing governmental/organisational science policy (ii) Soliciting public input in science policy/research (iii) Identifying new challenges in need of scientific research (iv) Building research calls/processes (v) Advertising such research calls (vi) Vetting submissions received (vii) Choosing winning applications (viii) Funding scientific research projects (ix) Defining research success/impact (x) and Measuring research success/impact. Whereas the public policy role and measurement of success and impact are important functions of SRFAs, this research specifically examines the remaining tasks completed and the associated call processes. Traditionally, these processes are either completed entirely inside the initiating agency or with the input of external consultants. Building and assessing scientific research projects in present times is a difficult process involving the completion of fragmented tasks as outlined above. Existing processes differ between institutions, however, the call process can largely be explained by the process tasks and their associated challenges viewed from the SRFA perspective at Table 1.;

Table 1. Existing SRFA challenges

Steps	Agency Tasks	Associated Challenges in..
1	Examine Government Policy Criteria for adoption	-examining and implementing state science policy
2	Obtain funding from the exchequer	-operating upon one or limited sources of funding
3	Design Call based upon policy objectives identified	-designing a call process cognisant of scale, complexity, time and transparency considerations
4	Define success/impact	-ensuring success criteria meet international standards and

	objectives	governmental objectives
5	Advertise Call	-ensuring an inclusive catchment of stakeholders are engaged using appropriate technologies
6	Accept submissions	-ensuring the process is equipped to accept vast, varied or diverse types of submissions
7	Review Submissions	-designing a transparent peer review process that is flexible as to the differing levels of assessment skills required
8	Award Management	-selecting appropriate winners best meeting the assessment criteria
9	On-going review	-ensuring funded projects are monitored, reviewed and assessed in an efficient and transparent manner
10	Measure success/impact	-ensuring success/impact metrics meet international standards and are properly applied

1.2 CROWDSOURCING

Crowdsourcing as a means of open collaboration can present innovative solutions, to many if not all the above challenges, with several noted advantages to the use of the crowdsourcing process by SRFAs over (i) traditional call processes and (ii) other types of open collaboration processes. On the first count a unified crowdsourcing process can facilitate the completion of many of the above tasks in parallel through one process rather than a series of fragmented projects. Secondly, research has show that the distance search aspect of crowdsourcing has facilitated obtaining the best solutions from domains external to that of the sourcing initiator providing heterogenic solutions over homogeneity. Thirdly, crowdsourcing as a process facilitates inclusivity and places all participants on the same page throughout the process. Fourthly, crowdsourcing initiatives can be scaled rapidly to meet with challenges of complexity, scale and time. Fifthly, crowdsourcing has presented as a means to adapt the varying skill levels of participants to meet the needs of a specific challenge at various stages of a process. Lastly, research has shown that there is more likely to be better support for process outputs derived from an open and transparent process such as crowdsourcing. While theoretical reflections upon the crowdsourcing domain are of benefit to research generally a practical contribution is sought through this research whereby a framework is presented to public SRFAs to facilitate selecting, formulating and evaluating crowdsourcing practices. This will facilitate agencies in using crowdsourcing practices in assessing and funding scientific research. These practices are commensurate with stages of the process and specifically speak to challenges and needs identified in the traditional process. De facto the practices are fixes for existing flaws identified in traditional scientific research funding and assessment processes.

However, existing crowdsourcing processes present several main challenges for adaption by SRFAs to their needs. Firstly, a first principles review of existing frameworks outlined below at 2.1 has shown specific problems as to the development of existing crowdsourcing frameworks. Accordingly, a framework well founded in theory is required for selection prior to adaption. Such a framework will have to clear a threshold established by first

principles review criteria. Secondly, most importantly, the crowdsourcing framework selected for adaption will need to be adapted to the specific needs of public SRFAs where no bespoke existing frameworks are available to support such public agencies. Thirdly, many existing frameworks are presented as taxonomies and typologies and do not speak specifically to processes and practices making prospective adaption a difficult task.

2. RESEARCH OBJECTIVES

Accordingly, the following research objectives are advanced;

O1. To adapt a strategic framework for selecting, formulating and evaluating crowdsourcing practices for public SRFAs.

O2. To apply the framework as a lens to SRFA call assessment processes in;

O2.1 Identifying best practices used

O2.2 Highlighting challenges faced

O2.3 Benchmarking SRFA call assessment

O2.4 Making recommendations (for SRFA implementation of crowdsourcing practices)

2.1 FIRST PRINCIPLES REFLECTION

For the purposes of finding a suitable framework for adaption a first principles review of crowdsourcing literature and frameworks was completed. The application of first principles as lens to a problem space finds ancient origins in the works of Aristotle. It involves the formulation of constructs by reasoning from the ground up. This runs contrary to the process of reasoning by analogy, which involves construct formulation through comparing similarities and dissimilarities. The first principles process involves reflecting upon meta-components at the root of a concept. Each component is examined under various headings to test its truth. Thereafter, a construct is assembled from components that pass the test as to their holism and integrity. A review of existing crowdsourcing frameworks from the first principles perspective has identified numerous problems with existing frameworks. First principles review finds application in various domains including computational chemistry, applied physics, educational science, materials science and information systems research. Through a reflection upon literature various categories of errors are identifiable through the application of first principles. By way of example an application of first principles reflection in the domain of Agility [3] presented several categories of deficiencies in existing attempts to categorise and taxonomise the domain. The categories highlighted have been in turn applied to existing crowdsourcing frameworks so as to discard unsuitable frameworks and identify a suitable framework for adaption. A first principles reflection upon crowdsourcing literature across domains provided the following categories of observations;

2.1.1 *Lack of clarity;*

This category examines the lack of evidence of a concept been clearly communicated and understandable. In the crowdsourcing literature across disciplines great confusion exists as to the definition of what constitutes crowdsourcing. Some authors have described the domain as a trend.

2.1.2 *Lack of theoretical glue;*

Secondly, a concept lacks theoretical glue where there is a lack of a strong underlying logic and rationale. There have been specific calls from research for the advancement of theory in the area of crowdsourcing to combat this problem.

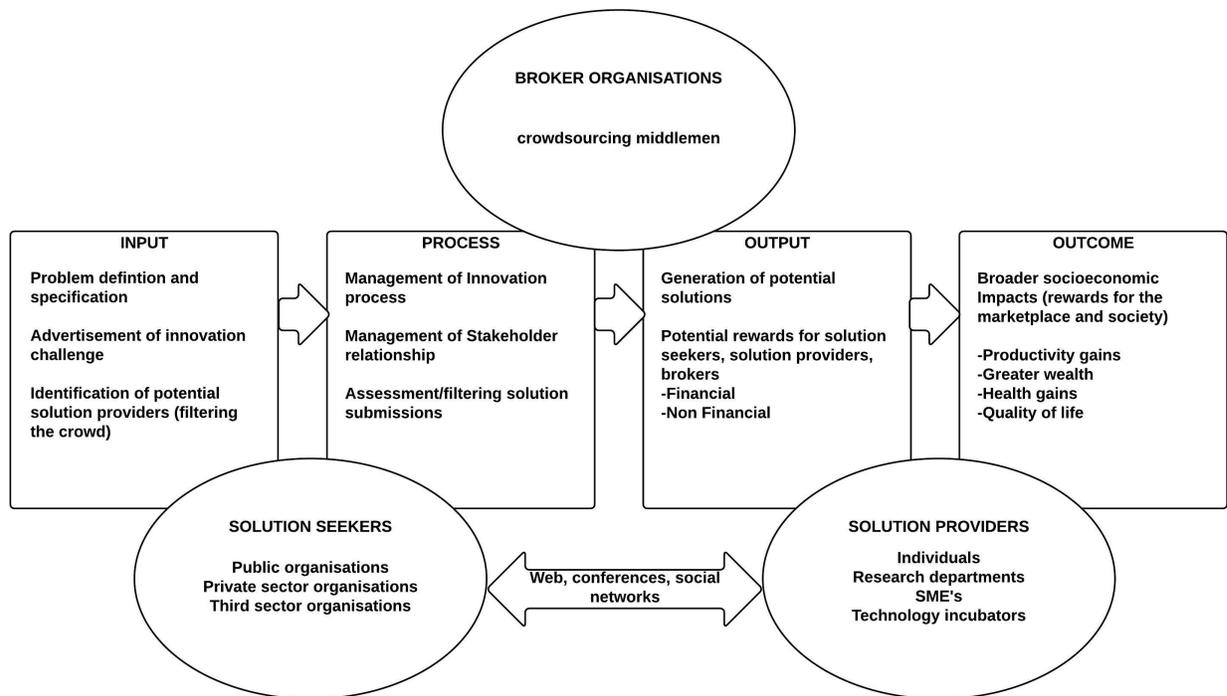


Figure 1. Stages in the crowdsourcing process and key players Marjanovic et al, 2012.

2.1.3 Lack of cumulative tradition;

Thirdly, existing frameworks show a lack of presence of theory arising from cumulative development upon concepts established in existing research. Many existing frameworks do not build on existing or established frameworks.

2.1.4 Lack of parsimony;

Fourthly, from existing frameworks we see a lack of evidence of a parsimonious approach in framework construction. This would involve removing any factors that provide little additional value to our understanding of a phenomenon. Various existing crowdsourcing frameworks show evidence of composite factors that add no value.

2.1.5 Limited applicability;

Lastly limited applicability as a category addresses the lack of applications of a concept. A good example of the strength of a concept is where it is applicable across domains or over a range of uses.

2.2 BASE FRAMEWORK

Having studied some twenty-eight competing open collaboration frameworks it is posited that the Marjanovic framework [6] at Figure 1 above that shows good foundation from the first principles perspective for (i) revision and (ii) extension to meet the needs of SRFAs. From the first principles perspective the framework of Marjanovic et al presents numerous advantages over other frameworks [6]. Firstly, the framework is based upon a clear and unambiguous presentation of the concepts central to crowdsourcing. It addresses not only the actors involved but also the processes involved. Such clarity is advocated as supportive of strong theory development. Secondly, the framework is presented subject to the author's call for theoretical investigations and frameworks. In the case of the framework presented it presents

sufficient theoretical glue firstly, contextualised in established open innovation literature and secondly from reflection upon core case examinations of leading applications of crowdsourcing. Thirdly, the framework shows clear evidence of cumulative tradition having been developed not only from an open innovation context but also from reflection upon other choice crowdsourcing definitions and frameworks. Fourthly, whereas there is no specific evidence as to parsimonious choice on the part of the authors in framework assemblage, clear distinctions have been drawn between crowdsourcing and other forms of open innovation thereby confirming that surplus or unnecessary components have not been assumed from other forms of open innovation.

Lastly, it is important to note that the framework requires adaption in several key areas. Firstly, the framework presented at figure 1 is a general framework and not tailored to the specific objective of SRFA's. Secondly, an important function of SRFA's is the raising of capital for the funding of projects. It is posited that the framework can be extended to facilitate other sources of research funding such as crowdfunding. Lastly, practices identified as suitable to the needs of SRFAs can be inserted into the different framework stages.

3. AN ADAPTED FRAMEWORK

Categories of crowdsourcing practices have been identified from the literature that affect the 'INPUT', 'PROCESS' and 'OUTPUT' stages of the framework for insertion into the adapted version. The practices where identified at the data stage collection of this research will be categorised as follows;

(i) *Practices focused upon engaging Internal/External participants:* Evidence exists of organisations using both internal and external crowds in seeking solutions to challenges e.g. IBM Innovation Jam [5] and internal crowdsourcing [9].

(ii) *Practices focused upon engaging Online/Offline participants:* Historical examples exist of crowdsourcing where no information

technology is used. For crowdsourcing to be truly effective offline participants must also be engaged in the process.

(iii) *Practices for engaging Known/Unknown participants:* [8] states that, “a crowd can be defined as a large set of anonymous individuals”. However, evidence exists of platforms providing participants with the opportunity to be identified or anonymous.

(iv) *Practices for managing Skilled/Unskilled participant engagement;* Crowdsourcing projects can require skills ranging from complex [4] to menial (e.g. Amazon Mechanical Turk).

(v) *Practices that assist Human/Automated task engagement;* Evidence is available of automated systems been used in open innovation platforms. Such systems could play a bigger role in the future crowdsourcing initiatives.

(vi) *Practices that facilitate Collaboration/Competition;* Terms such as ‘coopetition’ [7] and ‘tournament’ [1] have been used to describe behaviours evident in various open tournaments. Such evidence of competition and collaboration is evident in many crowdsourcing initiatives.

(vii) *Practices that facilitate Exploration/Exploitation:* [11] addresses the trade-off between exploration noting the sacrifice of near-term gains in making optimal decisions based on the currently available information. In managing many crowdsourcing initiatives participants make judgements calls based on such scales.

(viii) *Practices for setting Intrinsic/Extrinsic rewards and motivations;* Rewards and monetary incentives are a key concern for many crowdsourcing participants [1; 2]. The managers of crowdsourcing initiatives are faced with the challenge of finding a balance between intrinsic and extrinsic rewards.

(ix) *Practices for Bounding/Unbounding;* Herbert Simon developed the concept of “bounded rationality” [10]. In applying this concept to crowdsourcing we see that crowds can pick a solution to “satisfice” particular challenge criteria through a process of bounding requirements at a specific level.

4. PROPOSED METHODS

At present I propose using a combination of exploratory surveys and case studies to obtain data in support of the framework. The proposed approaches will focus upon the managers of scientific research funding agencies and the managers of crowdsourcing initiatives. The data collection process has several aims. Firstly to confirm the challenges faced by SRFAs in context. Secondly, to confirm the exemplary crowdsourcing practices identified in the literature outlined at 3 (i) – (ix) above.

4.1 RESULTS

The research is presently at a pre-data collection stage.

5. ACKNOWLEDGMENTS

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