The Development of a Public/Private Model for the Crowd-funding and Crowdsourcing of Scientific Research Projects

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Abstract

Crowdsourcing and crowd-funding have dramatically changed the way we innovate and the way we finance projects. In information systems (IS) literature there is a clear distinction between the crowdsourcing / crowd-funding models used in private organisations and in public organisations. The funding and creation of scientific research initiatives bear their own unique challenges from the IS perspective. The structuring of the systems to facilitate such research directly impacts upon the success of the process. In the present competitive research climate, crowdsourcing and the associated process of crowd-funding represent a means for public and private organisations to fund and facilitate scientific research. Whereas research has sought to categorize crowdsourcing / funding into various forms there is no specific model available to direct organisations that have both public and private components as to how to use crowd-funding and crowdsourcing in scientific research projects. The adoption of a design science research approach to the construction of a hybrid crowd model is advanced in this research-in-progress paper, which forms part of a larger project taking a first principles IS approach to crowdsourcing and crowd-funding.

Keywords: Crowd-funding, Crowdsourcing, Design Science.

1 Introduction

Organisations have moved from looking internally for solutions to challenges to external mechanisms such as crowdsourcing (Howe, 2006). Crowdsourcing and Crowd-funding form part of the open innovation landscape (Chesbrough, 2003). Research group Massolution concluded that in 2013 crowdsourcing would raise an estimated $5.1 Billion USD. Furthermore, Daryl Plummer of Gartner has posited that by 2017; "over half of consumer goods manufacturers will achieve 75% of their consumer innovation and R&D capabilities from crowdsourced solutions" (Plummer, 2013). Other related external solution seeking mechanisms include crowdsourced design, the wisdom of crowds, open source, citizen science and social innovation. Web 2.0 and the explosion in the use of social networking have provided traditional bricks and mortar industries with the opportunity to source solutions, ideas and funding from external sources without the employment of traditional solution sourcing methods or practices. Third party crowd-funding and crowdsourcing sites have enabled many ventures in making it to market that would otherwise have failed under more traditional project development systems. Capital formation has been shown "to be essential to economic developments, as it enables entrepreneurs to create new solutions to opportunities" (Lehner, 2013, p.9). Through harnessing the power of "the crowd" a greater degree of expertise or greater amounts of funding can be reached. The short-circuiting of traditional bureaucratic internal development/funding systems has meant that product releases or funding objectives can be met within much shorter time periods than under traditional systems. This has been evidenced by the success of certain recent research projects funded on the portal KickStarter. The process of funding scientific research can be particularly slow which in turn has a direct effect on the rate at which new innovations reach the market place. Many research projects have turned to alternate means of funding scientific research projects (Perkmann et al, 2007). Science funding processes worldwide have been heavily affected by the global financial crisis (Marder, 2013).

2 Motivation for Research

It is becoming increasingly difficult for science funding bodies to finance jointly led research between public and private organisations. Serious challenges have been levied against the research community in terms of budgetary cuts and staffing reductions (Mixon, 2012). Furthermore, substantial difficulties exist between industry and academia in terms of the conclusion of agreements covering issues such as funding and intellectual property rights. Crowd-funding and crowdsourcing do not present a universal IS solution to such challenges. One prominent scientist has noted that the; "problem with crowdfunding is that chances of funding depend primarily on the skilled presentation of a project, and not on its potential scientific relevance" (Hossenfelder, 2013). Accordingly, a new dynamic approach is required in terms of how such projects are structured and financed. Crowdsourcing and crowd-funding can present solutions whereby unpopular scientific projects that are necessary can be more readily funded. A major problem in scientific funding has been an overemphasis by private and public initiatives on popular projects of the day (Biba, 2013).

As dynamic solutions, crowdsourcing and crowd-funding present immense opportunities to funding agencies, industry and academia. However, whereas numerous examples are available of the use of crowd-funding by private entities and crowdsourcing by public, charitable and philanthropic agencies, little by way of examples exist of the hybrid use of crowdsourcing / crowd-funding by public/private initiatives. To successfully support research, agencies are required to work with both public and private organisations. It has been argued by commentators that science-funding bodies should adopt a more collaborative approach to funding projects (Dragojlovic, 2013). At the intersection of people, processes and technology, crowdsourcing and crowd-funding present challenges to model design and model creation from the IS perspective.

In particular challenges are presented on several fronts;

- Crowd Specification: The crowd can be of limited or sufficient expertise for the tasks required. The crowd can be known or unknown and internal or external to the organisation. The design of the crowd can have a direct effect on the success of the initiative.
- Problem Specification: In a dynamic crowd contest or collaboration, the crowd can design the problem criteria to be addressed by the process.
- Solution Specification: The crowd can mediate or adjudicate on submissions and iterate or accept various solutions advanced in the process.

It is posited by this research that a new hybrid public/private crowdsourcing and crowd-funding model is required by science funding agencies. Given that there has been little research on public/private crowd-funding and crowdsourcing initiatives, and to the best of our knowledge none specifically on the construction of associated hybrid models, our research seeks to identify and design the process for the construction of such an appropriate model. In the context of this study, a model refers to the mechanism by which public/private initiatives fund a research initiative or source solutions to a project challenge or requirement. As a research-in-progress, the objective is to firstly investigate and identify the core components of different crowdsourcing and crowd-funding models with the view to the design and creation of a hybrid model. The next sections of the paper summarise the extant literature and describe the methodological approach adopted in this study. A mechanism for the design of a preliminary public/private crowd-funding crowdsourcing model is advanced. The paper concludes with a discussion of the next stages of research proposed.

3 Background

3.1 The Funding of Scientific Research

The process for traditional funding of scientific research is linear in nature and bears similarity to a "waterfall" process. The process generally starts with a call for proposals. Thereafter, submissions are received and vetted. A winner is then selected from the submissions received. Several problems exist with present funding models used by scientific research funding agencies. Traditional models of funding calls, proposal reviews and outputs are often limited by an over-reliance on public funds or difficulties in sourcing interested contributors and funders (Muscio et al, 2013). Furthermore, enabling multi-disciplinary research or integrating academia, industry and government can be difficult process fraught with challenges. (Leydesdorff, 2000). Research has also shown intellectual insularity in project selection mechanisms (Benner et al, 2000). As funding sources become harder to find or more disparate (Marder, 2013), funding agencies will need to be more dynamic in their abilities to raise capital and locate solutions to challenges. To this end alternate means such as crowdsourcing and crowd-funding can be used (Perkmann, 2007).

3.2 Crowdsourcing

Crowdsourcing and crowd-funding form part of the open innovation landscape (Chanal-Fasan & Caron, 2008). Open innovation is a paradigm that assumes that firms can exploit both internal and external ideas and channels to market (Chesbrough, 2003). Crowdsourcing in its modern definitional instantiation has been with us less than a decade (Howe, 2006). Various attempts have been made to codify crowdsourcing and generate a taxonomy of the landscape (Brabham, 2010; Geiger et al, 2011; Saxton et al, 2013). Some commentators argue that crowdsourcing has been with us in various forms for hundreds of years if not millennia. Examples of calling upon the crowd exist throughout history. Such examples include the Oxford English Dictionary, a seventeenth century crowdsourced calculator and Finnish Talkoot (ArticleOne, 2011). For instance, the Finnish Talkoot bears special mention where commentators have highlighted the similarities between crowdsourcing and the various ancient forms

of Talkoot (Aalto, 2008). Indeed some commentators have observed that it might only be a matter of time before the term Talkoot enters the language of crowdsourcing (Paterson, 2010).

It is important to note that crowd-funding as a mechanism finds its origin in crowdsourcing. However, where the former mechanism deals with financing projects the latter mechanism deals with solution seeking. In literature, there is some confusion as to the structures and applications of both mechanisms. However, this confusion has not stopped the successful application of both processes by public and private entities. For instance, Cancer Research UK in conjunction with Amazon Web Services, Facebook and Google developers joined academics, scientists, gamers and designers for a weekend called GameJam to create a fun, engaging game that translated data to assist scientists in processing cancer related scientific data. The game helps scientists with the mass processing of cancer research data that would otherwise have taken significantly greater amounts of time to complete (Play To Cure, 2013). This presents a contemporary example of science calling upon a diverse crowd containing different types of organisation for solutions.

3.3 Crowd-funding

Crowd-funding has been defined as involving the raising of; "private funds via the Internet in relatively small amounts from a relatively large number of investors who may be future customers of the product(s) of the entrepreneurial firm being financed or from those who are otherwise interested in the success of the entrepreneurial firm (without the help of financial intermediaries and with out the need to conduct an Initial Public Offering (IPO))" (Chemmanur & Fulghieri, 2010, p.3). Furthermore, Belleflamme defined crowd-funding as involving "an open call, mostly through the Internet, for the provision of financial resources either in the form of donation or in exchange for the future product or some form of reward to support initiatives for specific purposes" (Belleflamme, 2012, p.7).

Various indicators have shown that crowd-funding is progressing as a contemporary means of funding enterprise over more traditional forms such as venture capital and initial public offerings (IPO). For instance, US research firm Massolution found that the crowd-funding market had grown 81% in 2012 and that crowd-funding platforms raised $2.7 billion over more than one million campaigns (Moebius, 2012). In the United States the JOBS Act of 2012 has legalized equity crowd-funding as a means of providing capital to start-up businesses (Goings et al, 2014). Nonetheless, unique challenges are faced in crowd-funding scientific research initiatives. Firstly, perceived popularity can be a factor in whether or not projects receive funding. This fact does not always meet the requirements of scientific research. Traditionally, the more popular viral projects are for crowd-funded videogames and movies. Research has shown that social, entrepreneurial and artistic projects are more likely to crowd-fund successfully (Belleflamme, 2012). For example, in the UK, documentary producers are increasingly looking towards crowd-funding for project capitalization (Sørensen, 2012).

Secondly, present funding systems are outdated. "Basic biomedical research uses advanced 21st century technology, but is still fueled by a clumsy, archaic government-grant funding model that even predates the Internet" (Perlstein, 2012). The time constraints of scientific research do not always coincide with funding changes and the volatility of funding arrangements. One such example details where an assistant professor of oncology immediately stopped advanced research in the area of tumors where she had been notified of sudden funding changes to the research. The project in question was immediately placed on hold (Marder, 2013). Despite the challenges, success has been enjoyed by scientific projects on sites such as IndieGoGo, RocketHub and Medstartr. These successes are transforming the way scientific research is funded today. With crowd-funded science projects several portals are now making substantial funding breakthroughs (Wheat et al, 2013). RocketHub has been used to crowd-fund various types of scientific projects related to pharmacology, DNA and the study of insects (The Economist, 2012). Furthermore, science specific platforms such as Petridish and Microryza are facilitating scientists in directly raising funding for scientific research. A project called iCancer on Indiegogo led by Alexander Masters raised in excess of 2 Million USD for cancer research (Masters, 2012). The crowd-funding project reached its funding goal and went on to assist a research

team at the University of Uppsala, Sweden led by Professor Magnus Essand in bringing a cancer treatment towards clinical trials.

4 Artefact Development

Larralde & Schwienbacher advance various business models for crowd-funding including donations, passive and active investments by the crowd (Larralde & Schwienbacher, 2012). The donations model is where finance is donated in a mono-directional format. Passive systems, on the other hand, see investors getting a return but the relationship does not extend beyond a rewarding function. By contrast active investors are also included in the "constant dialogue" of the process (Lehner, 2013, p.8). According to Lehner, most focus on crowd-funding has traditionally extended to donation based crowd-funding. However, this author reviewed extant literature on financing social ventures and crowd-funding and advanced a schema of crowd-funding's inner workings in a social enterprise context. The schema proposed by Lehner has some similar actors to the proposed preliminary model herein. The schema, however, does not take into account aspects of scientific research funding incorporating a for-profit element. Scientific research funding exists somewhere between social enterprise and for-profit endeavours depending on the extent of the financial and intellectual property commitments delineated within the call.

Accordingly, from existing research (see Larralde & Schwienbacher, 2012; Lehner, 2013; Etzkowitz & Leydesdorff, 2000) the constituent actors and processes involved in the targeted part of the crowdsourcing/crowd-funding landscape are apparent. Comparison of the actors within such models and schema suggest that actors within a public/private science funding process include; the crowd, academic institutions, industry, science research funding providers, a web based portal, charitable contributors, philantropic contributors, government funding departments and private investors. Some actors can have more than one relationship with a science funding agency, whereby they can either invest in a project for reward, make a donation not based upon reward and share in a part of the intellectual property behind certain projects. This form of multi-relationed approach is outlined in the preliminary model advanced in Figure 1 and represents a significant departure from the more traditional models for the funding of scientific research. Such a model would supplement "The Triple Helix Model" of university–industry–government relations as advanced by (Etzkowitz & Leydesdorff, 2000) with the crowd and web portals now joining the landscape. With the advent of the integrated web 2.0 portal, all of the actors involved in the system can be involved in crowd specification, problem specification and solution specification unlike traditional systems where the relationship between actors are dyadic in nature.

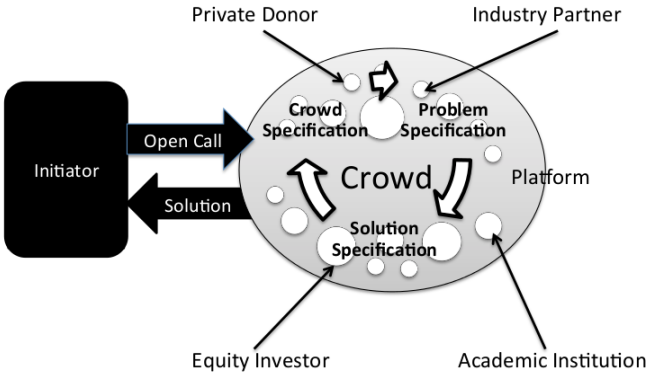

Figure 1. Preliminary hybrid crowdsourcing/crowd-funding model

5 Design Science Research

It is not enough for design artefacts to 'come out of the blue' (Iivari, 2007, p.52) and to this end a model can be created from theory to not only address the 'practical problems' of building scientific research projects but to also utilise the opportunities presented by the crowd. The main methodological system proposed for the development of the public/private crowdsourcing/crowd-funding model lies in a design science research paradigm. Design science is advanced as a suitable system for the development of such an artefact (model) whereby a robust iterative process is presented towards artefact development (Hevner et al, 2004). Design science finds origin in various areas related to the study of design and in particular the work of Herbert Simon (Simon, 1996). The challenges in the context of designing suitable models for public private research formulation and funding initiatives present unique problems in a crowdsourcing and crowd-funding context. The research in question does not set out with the specific purpose of design theory development (Gregor & Jones, 2007) however, it does acknowledge that a theoretical position can be adopted in identifying existing components of crowdsourcing/crowd-funding and instantiating same into a new hybrid model. In DSR artefacts can take the format of constructs, models, methods, and instantiations (Gregor & Hevner, 2013).

Furthermore, Gregor & Hevner present a framework for evaluating knowledge and the research contribution of a design science work. To this end a structure presented facilitates the researcher in examining the maturity of the problem domain and the maturity of the solutions space. From the problem domain maturity perspective a hybrid public private model presents a new solution to a problem, whereby no existing models are available to address the lacuna. From a solutions maturity perspective, adopted solutions are available in other domains and can be applied in the creation of a new model as posited by this research. Under the criteria set out by Gregor & Hevner, such a research contribution would represent an 'exaption' research contribution (Gregor & Hevner, 2013, p.345). Exaption is defined as a shift in the function of a trait during evolution. It is posited through this research that where new funding mechanisms and models are evolving, a fundamental shift in the design or architecture of same represents an exaption.

The model in question is of specific utility whereby a traditionally linear process can now adopt iterative cycles. To acheive this utility the design process will be required to instantiate appropriate processes and filters into the crowd engagement platform. Under current practices models used feature a very specific format tailored towards either private industry or public requirements. The design process will have to generate a new model capable of encompassing both perspectives to suit the needs of scientific research projects.

Various call selection mechanisms and participation architectures are available for private and public methods respectively. However, a hybrid public/private model is not available at present. Design science research has been advocated as a means of model development (March & Smith, 1995; Goldkuhl & Lind, 2010). With regard to design science research concerning models, March and Smith state that; "models aid problem and solution understanding and frequently represent the connection between problem and solution components enabling exploration of the effects of design decisions and changes in the real world" (March & Smith, 1995, p.78-79). To this end the crowd-funding model sought represents a pure connection between a specific problem or challenge in the form of financing and the required solution in the form of an appropriate funding mechanism. Goldkuhl states that, "models are thus defined as situational representations" (Goldkuhl & Lind, 2010, p.46). The research in question seeks to identify the components within a model in their situational context.

5.1 Research Stages

Design Science research takes place over several stages and involves three core cycles (Hevner, 2007). At present our research is half way through the first stage of the research process whereby a systematic review of the public/private funding systems is been completed through the review of extant literature

in the research area. Furthermore, the objectives of such entities are been examined. This process has been used to identify both problems and opportunities in existing scientific funding models. A preliminary mechanism has been developed to help identify the position of science funding agencies in the overall crowd-funding landscape. This has been completed for the purposes of identifying similar users of crowd-funding so that comparisons can be drawn from the funding models and processes used by those entities. Design Science Research parallels the method advanced by Peffers et al. (2008) and includes the following stages; (1) identify problem; (2) define solution objectives; (3) design and development; (4) demonstration; (5) evaluation; and (6) communication. Within the model development process the specific problems identified from the present research relating to science funding have been examined in the first stage of the research completed. Although, it has been suggested that crowdsourcing and crowd-funding can be used to meet these challenges, no present model exists to meet these challenges.

6 Next Stages of Research

As an artefact the proposed model leverages web 2.0 technologies in an effort to coordinate engagement of the crowd. The implications of such a model for scientific research are significant in the sense that the model addresses a number of challenges simultaneously. Firstly, rather than relying upon the management of existing dyadic relationships, the portal simultaneously broadcasts and engages multiple diverse parts of the crowd. The model facilitates this process. Secondly, the model operates irrespective of the business models deployed by various parts of the crowd. Under the model advanced by Lehner, the process is affected by whether or not an active, debt, equity or passive business model is adopted in the process (Lehner, 2013, p.9). Under the model advanced herein the web 2.0 platform operates externally to the business models of the crowd. Accordingly, the proposed model introduced increased flexibility of use for both the initiator and the crowd over existing models.

The next stage of the present research will involve the identification of call construction components from similar existing systems meeting with the objectives of the public/private entities. Entities that bear similar traits to private and public crowdsourcing and crowd-funding initiatives will now be examined from the perspective of call construction and participation architectures used in crowd-funding and crowdsourcing processes. Any specific considerations identified from this stage of the research will be worked back into the model under development. It is posited that the design science research paradigm is particularly pragmatic in the provision of development method for ideating and creating a model artefact and in particular meets with the requirements of the next stages of the research.

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