

# Crowdsourcing and Crowdfunding Mechanisms for Scientific Research Funding Agencies – A Preliminary Entity Categorisation Matrix (PECM)

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## Abstract

Research has shown that crowdsourcing and crowdfunding are accelerators and facilitators of societal, business and institutional change, presenting numerous potential benefits to the triple helix of government, industry and university. Scientific Research Funding Agencies play an important role in the triple helix and play an important role in the development and instantiation of public policy. E-participation and e-government platforms have invited a new actor to the triple helix in the form of the crowd. The citizen as a member of the crowd presents potential solutions to public needs. This paper shows that whereas numerous models are available for the private and public use of crowdsourcing and crowdfunding, a limited number of models are available for use by science funding agencies. Accordingly, this research in progress paper attempts to fill this gap by examining the actors involved in the crowd process and presenting a preliminary categorisation of the associated types of users of the crowd. This paper is part of an overall project that focuses on building a suitable crowd model for these agencies. The research herein advances a Preliminary Entity Categorisation Model (PECM) to facilitate this process.

**KEYWORDS:** Crowdsourcing, crowdfunding, citizen science, triple helix, scientific research funding agencies

## 1. Introduction

Crowdsourcing and crowdfunding find their origins in the open innovation landscape (Chesbrough, 2003). Both models represent dynamic means by which an entity can seek solutions or funding in response to operational challenges. Through the interaction between an initiator, a platform and the crowd, solutions to challenges are sourced. Many third party crowdsourcing and crowdfunding websites have emerged, facilitating organisations in locating a vast and varied number of responses to challenges. In the traditional context solutions were located inside the organisation. With the move towards open innovation, solutions are now located outside the organisation in the context of partnerships and relationships. With the move towards the crowd, solutions can be sought even further beyond organisational boundaries where in many cases the location and skillset of the crowd are unknown. Research has shown that unique and novel types of solutions can be sourced from the crowd that would otherwise not be attainable from traditional systems. Examples include the

search for a cure for the M-PVM on Foldit which used crowd technologies to process large amounts of data (Khatib et al., 2011). Furthermore, the Royal Society of Chemistry ran a competition addressing the “Mpemba effect” and crowdsourced 22,000 submissions to an age old scientific problem (Royal Society of Chemistry, 2014). This study adopts an Information Systems Research (ISR) perspective in addressing the challenges associated with building crowd models for scientific research funding agencies (SRFA’s). Information systems (IS) research is concerned with the interaction between people, processes and technology. No greater example exists of this problem space than in the context of calling upon the crowd. Yet information systems research has only minimally engaged with the crowd (Majchrzak and Malhotra, 2013). This is despite the fact that IS research addresses a problem space overlapping people, processes and technology and as such is a pertinent paradigm for addressing such problems. In reaching towards the crowd, governments are adding the citizen into the complex relationship between, government, business and science.

A plethora of classifications and models now exist for businesses and charities to execute crowdfunding and crowdsourcing initiatives (Brussee et al., 2013, Saxton et al., 2013, Lehner, 2013). In addition to taxonomies numerous typologies also have been advanced (Dawson, 2010, Meier, 2009, Carr, 2010, Derek et al., 2013, Stanoevska-Slabeva, 2011) Yet very few examples exist of crowd models constructed for the specific purposes of SRFA’s. This is despite recommendations that crowdsourcing and crowdfunding are suitable for scientific research (Dragojlovic, 2013, Wheat et al., 2013, Schmitt, 2013). Science funding agencies play an important role in the triple helix of government, industry and universities. Recently, governments have begun to engage further with the crowd in an effort to seek solutions to common societal problems (Brabham, 2013, Franzoni and Sauermann, 2014, Madison, 2012). Whereas the construction of scientific research projects traditionally involved predominantly experts the process now has the option to involve citizen scientists and citizen funding through crowd models. The enhancement of scientific research and innovation has long been regarded as a core component of public policy and government (Teece, 1986, Nelson, 1971). In categorising different types of crowd, user similarities and distinctions can be drawn between the different crowd models used by these entities. This research in progress forms part of a greater initiative to build a crowd model relevant to the specific needs of SRFA’s. As such, this paper advances preliminary observations in response to these questions in the form of a categorization matrix.

Primarily, entrepreneurs and start-up businesses have called upon the crowd in an effort to construct or finance enterprise. Furthermore, crowdsourcing has been used to great effect by philanthropic and charitable organisations in raising both finance and assistance for good causes. Governments have now seen the value of the crowd and in several jurisdictions public bodies have created enabled portals seeking solutions to public needs and challenges. In the context of this research examples exist of public bodies using crowdsourcing and crowdfunding systems both inside and outside the organisation. To this end rather than drawing distinctions between crowdsourcing and crowdfunding mechanisms we address both methods under a unified heading of crowd

initiatives. Furthermore, as SRFA's are public bodies, in locating a sample of crowd projects to examine we selected a minimum criteria where one or more of the process instigators held non-for-profit objectives. This is in recognition of the fact that SRFA's are primarily non-for-profit bodies performing a function of public policy namely driving innovation and R&D. Solely private entities for profit were disregarded from the research in light of the fact that SRFA's do not engage in exclusively for profit works.

This article is organised as follows. The following section outlines the research objective and identifies the main stakeholders namely the crowd and SRFA's. The second section provides an IS perspective on the crowd, followed by an outline of the research methodology. The third section features a Preliminary Entity Categorisation Matrix (PECM) and the categorisation criteria identified from the research are advanced. The final section summarises the preliminary results and gives an outlook for future research.

## **2. Research Objective and Questions**

The objective of this study is to advance a novel categorisation matrix that can be used in categorising crowd initiatives. Two research questions have been formulated to achieve this objective:

1. What entities in a non-for-profit context use the crowd?
2. What are the core criteria upon which similarities and distinctions can be drawn between these entities for the purposes of categorising crowd initiatives?

## **3. Calling upon the crowd**

With regard to crowd, the terms crowdsourcing and crowdfunding are relatively new "coined" terms (Howe, 2006, Sullivan, 2006). Various definitions have been advanced throughout information systems literature and some confusion exists as to an exact definition of crowdsourcing. In particular differences of opinion exist as to whether or not the crowd must be known or unknown and whether or not web 2.0 technologies must be used (Estelles-Arolas and Gonzalez-Ladron-De-Guevara, 2012, Saxton et al., 2013). Furthermore, many of the definitions at use in information systems relating to crowd use the term "open call" to describe the process by which a challenge is put to a crowd for solution. Some researchers observe an open call process where a truly unbounded and unknown crowd are called upon for solutions to challenges. This is particularly true in the context of micro-tasking. However, other types of call requirement exhibit a minimum level of expertise or identification from the participants to engage. None is more evident than in the case of software design and testing. For software design and testing varying degrees of expertise are required as exhibited through software testing websites. This is also the case for many types of scientific research process where a great level of expertise is required to complete many types of challenge.

An increased social interest in the use of the crowd has mirrored the recent advancement in the use of web 2.0 technologies. The Internet has served as a means for public and private institutions alike to attain greater access the crowd. However, in truth, crowd initiatives have been with us for centuries if not millennia. The British Longitude Prize of 1714 (Spencer, 2012) and Finnish “Talkoot” hannu (Miettenen, 2011) are historical examples of calling upon the crowd for solutions. As Oksanen states *“it’s good to bear in mind that the web didn’t invent crowdsourcing or crowdfunding – it just made it easier”* (Oksanen, 2012). Crowdsourcing is viewed as a subset of Open Innovation. Top Coder founder Jack Hughes points out that *“Open Innovation in our view is a larger concept and, depending on the mechanism used, a superset of Crowdsourcing – when the process and platform include finding a way to create something new”* (Bonner, 2013). Hughes points out that crowdsourcing generally relates to reducing cost whereas open innovation platforms are predominantly focused on creating value. This is an important distinction when compared against the objectives of SRFA’s. Whereas the overall goals of the agencies forms a broad part of public policy and the creation of value it can be argued that in seeking to expedite scientific research projects the process serves to reduce overall state costs. A key distinction between crowdsourcing and open innovation can be found in the users of the process. With open innovation the partners to a process are often known. By contrast, in crowdsourcing and crowdfunding the participants can often be unknown (Garcia Martinez and Walton, 2014). Many public open innovation initiatives call upon the crowd for solutions. For the purposes of this research it can be argued that several of the organisations studied fall into both the categories of open innovation and crowdsourcing/crowdfunding where members of a crowd are both known and unknown within the same initiative.

#### 4. Scientific Research Funding Agencies

Scientific research forms the cornerstone of economic development within a country and accordingly forms a major part of public policy for governments (King, 2004). Research has shown a direct correlation between the GDP of a country and it’s level of scientific research output (Vinkler, 2008, Lee et al., 2011). However, some authors have exercised a word of caution in respect of higher levels of government spending in R&D (Lang, 2009). SRFA’s form part of the government sphere in the Triple Helix Model (THM). The model was first advance by Leydesdorff in 1996 and features three core components namely, university, business and government. The model is regarded as a tool for measuring economic development within economies internationally. According to Ivanova & Leydesdorff (2014) the *“Triple Helix model assumes that the driving force of economic development in the post-industrial stage is no longer manufacturing, but the production and dissemination of socially organized knowledge”* (Ivanova and Leydesdorff, 2014). To this end one important component of the relationship stands out, namely “socially”. The term social encompasses societal interaction of certain actors. In this paper we advance the notion that the crowd as an organized segment of society has the ability to drive innovation, and R&D.

A main contemporary challenge in public policy is both the understanding and enhancement of the triadic relationship between science, government and industry. These relationships drive innovation and in turn drive state revenues. This in turn facilitates greater societal change. Within the context of the THM SRFA's are primarily public bodies that form part of the Government sphere. Examples exist worldwide of SRFA's that are not purely government and are part private organisation or part foundation. One such example is a joint scientific project operated by US agencies with the Australian (public-private) Cooperative Research Centre Association (CRCA) (Buessler et al., 2007). Notwithstanding the value of commercial research the importance of independent government funded scientific research is recognised whereby in contrast solely private sponsored research can have significant drawbacks (Bodenheimer, 2000, Tijssen, 2004). In researching bodies using the crowd the minimum criteria for consideration included at least one non-for-profit instigating actor.

Whereas the THM in it's traditional form has always represented the triad in recent years we see actors switching roles. In some cases universities create small innovative companies and by corollary industry has an important role to play in third level education (Ivanova and Leydesdorff, 2014). This is also reflected in public/private organisations and foundations engaged in funding scientific research. Accordingly, the traditional roles within the helix have become more diverse and at times interchangeable. Furthermore, a new enabling actor has entered the space in the form of the citizen as a member of the crowd. In viewing this problem space we must have regard for two guiding factors. Firstly, the THM gives us guidance as to the understanding of the relationship between universities, government and industry. In particular the related concepts of solution space and communication space creation. Secondly, open innovation provides guidance where external relationships outside the four walls of the organisation are required to enable innovation.

In the traditional scientific call selection process a call is formulated by the SRFA. It is advertised to specific members of the scientific community and appropriate applicants submit to the competition. Experts within the SRFA then assess the submissions and select a winner. Such a process can suffer from various challenges and limitations. Firstly, by setting narrow engagement criteria only a specific set of applicants with certain minimum professional qualifications can apply. This in turn means that a narrow number of applicants will produce an even narrower number of potential solutions. Secondly, in a system where entities are seen to have a higher standing repeated winners in such competitions will tend to traditionally come from the same institutions. Accordingly, repeat narrow misses will cause applicants to disengage from the competition process. This poses the challenge as to how SRFA's can keep a broad church of applicants interested and involved in the competition process.

## **5. An Information Systems Research Perspective on the Crowd**

Modern day crowd platforms rely upon the effective combination of the crowd, a platform through which to engage and a process or system through which decisions or solutions can be obtained. Websites such as Amazon Mechanical

Turk (Amazon, 2013), Kickstarter (Kickstarter, 2014), Indiegogo (Indiegogo, 2014) and Petridish (Petridish, 2014) have all thrived from the increased popular interest in calling upon the crowd for solutions. A plethora of different models exist in information systems research through which organisations or individuals can engage the crowd for solutions (Marjanovic et al., 2012, Lehner, 2013). Yet few such models exist for SRFA's to facilitate them in launching crowd initiatives. This is despite the numerous challenges faced by international scientific research communities in the construction and funding of scientific research. Firstly, traditional funding call mechanisms operated by government agencies can produce ineffective results (Dragojlovic, 2013) and more effective solutions are required (Pain, 2014). Secondly, pursuant to the global recession finance has become harder to source for projects (Mervis, 2012). Thirdly, agencies based in wealthy countries have to compete with jurisdictions where operating costs are lower and researchers are readily available. Fourthly, riskier science projects (i.e. fundamental research) that can produce extremely lucrative results are even harder to fund in a competitive environment (Remedios, 2000). As such, the crowd can provide solutions to many if not all of the aforementioned challenges. This research forms part of a greater initiative to address these challenges.

Much of the crowdsourcing and crowdfunding IS literature addresses crowd from the perspective of rewards, competition or collaboration as factors for delineation (Sauermann and Franzoni, 2013, Majchrzak and Malhotra, 2013). Research has also shown the relationship between success rates within competitions and rewards (Yang et al., 2008). Furthermore, distinctions are drawn in the literature between expert voting and crowd voting within participation architectures (Chen and Liu, 2012). What these distinctions reveal is categorisation based upon the types of decision mechanisms used within crowd initiatives. A categorisation matrix based upon rewards or decision mechanisms alone will not provide a sufficient basis for categorisation in this context based upon the fact that in many public crowd initiatives, there are no intrinsic rewards available for participation. Furthermore, in many public initiatives a suggestions perspective is adopted rather than the location of outright winners by voting systems or otherwise. An examples of this would include the search for flight MH370 (Fishwick, 2014) or collective disaster mapping solutions (Gao et al., 2011, Meier, 2012). Other categorisation efforts have divided crowdsourcing initiatives into government, non-government, active and passive initiatives for comparison purposes (Oksanen, 2012). In addressing the use of crowdsourcing by government Brabham sought to draw distinctions based upon the types of task to be completed namely; Knowledge Discovery and Management, Distributed Human Intelligence Tasking, Broadcast Search and Peer-Vetted Creative Production (Brabham, 2013). Such classifications are based upon the type of tasks to be completed. Other examples of classification include categories based upon desired process outcomes (Brussee et al., 2013). These types of categorisation adopt a task centric perspective rather than an entity centric perspective. In adopting an entity centric perspective, this research seeks to draw distinction between initiatives based upon the level of internality and externality, level of control and regulation rather than the type of task envisaged. In doing so we are categorising the users of the crowd based upon similar user

organisation types rather than desired outcomes. In doing so we believe this approach will provide SRFA's with examples of pertinent users of crowd based upon criteria best fitting the spirit and objectives of the agency holding both a sufficient level of crowd reach and project control.

## 6. Research Methodology

The research in question has produced a preliminary categorisation of over fifty entities using the crowd based upon the criteria of the level of internality and externality (openness), level of control and regulation. From a methodological perspective two approaches have been adopted within the research. Firstly, a substantial IS literature review has been conducted into the use of crowdsourcing and crowdfunding by public bodies (Webster and Watson, 2002, Levy and Ellis, 2006). The Web of Science (Reuters, 2014) and Scopus (Elsevier, 2014) were used as the two primary search databases. The literature review also assumed a format advocated by Levy and Ellis (2006) where fifty management information journals and sixteen ranked and non-ranked information systems journals were examined. Additionally, a host of weblogs and internet articles were also examined and, a review of over fifty related websites (see Appendix 1) has enabled the categorisation of crowd initiatives based upon the core criteria of openness and regulation. The model under construction is a preliminary model based upon the literature review and categorisation. The conclusions drawn will be modified in the development of an advanced model at later stages of the research.

## 7. The Preliminary Entity Categorisation Matrix

This research draws a distinction between public and private crowd initiatives models. Private crowd initiatives are completed by an instigating actor such as a private institution or body corporate for a personal gain, be it financial, philanthropic or otherwise. A plethora of examples exist on websites such as Kickstarter (Kickstarter, 2014), RocketHub (RocketHub, 2014) and Indiegogo (Indiegogo, 2014) whereby entrepreneurs, artists, film directors and musicians seek funding for projects with objectives that are personal to the instigating actor or institution. Whereas in the case of university crowd portals it can be argued that any benefits accrue for the public good it must further be noted that universities although state funded in many cases, are private entities capable of generating profits in their own right. In contrast with public crowd initiatives the distinction is clear. For a government or public agency the prospective benefits from the initiative accrue solely in favour of the state and are said to be in the public interest.

A distinction can also be drawn between the crowd initiative and the crowd platform. Crowd initiators have a choice to either host their own crowd portal or use a third party platform such as Kickstarter or RocketHub. Governments have used both internal systems along with third party platforms in calling upon the crowd. In these instances it is important not to confuse the crowd initiative with the platform. Rather than retaining express control of the crowd initiative third party platforms often take a fee or percentage of monies for usage. They do not

seek to retain ownership or control of the process outputs. In one such example Challenge.gov has been established by the Obama administration to crowdsource tasks of relevance to the US Government. Although the site lists many competitions it is a portal rather than a specific crowd project. The same applies to OpenIDEO's challenge portal. Where the platform on its own forms part of a greater non-for-profit initiative we have included the platform rather than individual projects as part of the list of websites for consideration. This is due to the fact that future SRFA portals may feature a multiplicity of projects on the platform. However, in these specific instances the platforms do not exist in a solely for-profit capacity.

It is proposed herein that appropriate factors for categorising crowd initiatives have been identified whereby the level of openness of the initiative is compared against the level of financial/intellectual property regulations surrounding the initiative. In simple terms the question is posed as to how far does the initiative reach and how are the outputs controlled.

**The above factors are advanced as categorisation criteria or several reasons:**

1. Having regard for the existing process needs of funding agencies, we learn that open calls for science funding are heavily controlled and regulated by either time, financial, regulatory or intellectual property constraints.
2. Such traditional calls feature actors both internal and external to the organisation, e.g. expert judges and applying research institutes / academic institutions.
3. Within the traditional call process only applicants meeting certain minimum qualification criteria can apply.
4. In practice where a crowd initiative is internal to the organisation there is concurrently a greater level of security and controls surrounding the initiative. This can be for reasons of intellectual property or state security.
5. Where a crowd initiative is seeking solutions external to an organisation there are by comparison less restrictions and regulations covering the call.

Accordingly, for such SRFA's, having the correct level of crowd reach is important as varying levels of crowd skill are required for various levels of tasks. Furthermore, it is envisaged that different levels of controls are required by agencies for certain types of project. For example where a crowd initiative is to produce valuable intellectual property, a greater level of control and regulation will be required compared to an initiative where a generic citizen science tasks are involved and no licence is required. In order to exploit the true dynamic nature of crowd, agencies need to move from the traditional call system into areas such as the involvement of citizen science or matched public/private crowdfunding initiatives. Numerous examples exist of governments calling upon citizen scientists (Madison, 2012) and creating internal or matched funding initiatives (Seattle Department of Neighborhoods, 2014).

**8. Entities in a non-for-profit context that use the crowd?**

The research identified several actors in non-for-profit crowd, i.e., bodies corporate, government, organisations and academic institutions (see results in

Figure 1 and Appendix 1 respectively). Whereas initial definitions of crowdsourcing focused on companies or organisations (Howe, 2006) as the crowdsourcer, later definitions were revised to also include non-for-profit or government entities (Estelles-Arolas and Gonzalez-Ladron-De-Guevara, 2012). A great number of examples exist within the literature as to who calls upon the crowd to seek funding or solutions to challenges. In calling upon the crowd their motivations range from charity to advancing the public good. Tasks can range from minimal such as micro-task processing (Kaganer et al., 2013) to complicated in nature such as software development (Stol and Fitzgerald, 2014). Public private partnerships can include part industry part academia, part government part academia or a combination of all three actors. Within these actor categories various sub-categories and composite actors were identified. With bodies corporate, the research identified businesses that were either for-profit in the context of driving non-for-profit agendas or supporting industries in socially targeted pursuits. The government actors include local government bodies, agencies, national governments and international composite government bodies such as the United Nations and European Union. Organisations include charities, foundations and philanthropic bodies. Academic institutions include universities, third level institutions and scientific research / teaching facilities. Composite actors and initiators are where two or more of the actors above form joint initiatives such as Dell's partnership with the University of Texas in IdeaStorm (Dell, 2014)

## **9. Core criteria upon which similarities and distinctions can be drawn between entities for the purposes of categorising crowd initiatives.**

### **A. Measuring Openness**

In 2003 Chesbrough defined the boundaries of the organisation as a funnel (Chesbrough, 2003). In the traditional closed innovation system the walls of the funnel are solid and innovation takes place internally. In the new open innovation paradigm the walls of the funnel are broken and innovation can take place both internally and externally to the organisation. This boundary is defacto a measure of openness. Ebner states that "*crowdsourcing opens the company's innovation funnel – the scope for screening ideas. Therefore, the company gains more ideas for innovations*" (Ebner et al., 2009). The same principal can in turn be applied to public crowdsourcing where the government or public body opens the boundaries of the organisation. With public crowd initiatives two levels of openness to the organisation can be identified. Firstly, initiatives that are entirely internal and secondly, initiatives where solutions are sought entirely outside the boundaries of the organisation (open). Madison (2012) in advancing openness as a concept identified formal and informal openness in the context of shared resources. However, this definition of openness related to the "formal and informal institutional mechanisms in place to manage or govern that openness" rather than a strict measure of internality/externality. Initiatives inside the organisation can include internal crowdsourcing (Byrén, 2013) and the associated intra-corporate crowdsourcing (Villarroel and Reis, 2010). In both cases the crowd are (i) internal and known (ii) exist within the boundaries of the Chesbrough funnel. In large organisations where ip/financial controls/security

are a concern questions remain as to how far the organisation should look outside its boundaries to seek solutions to challenges. Harvard Associate Professor Karim R. Lakhani has found in innovation competitions that solutions are frequently located from outside the challengers domain (Lakhani et al., 2013). However, this possibility for solutions must be in turn contrasted against internal crowdsourcing mechanisms used by entities where state security is at issue.

Within the initiatives examined several entities were identified that had initiatives that featured both internal and external process participants. Although limited in number compared to the majority of cases examined, these initiatives were listed at the Y axis intersection of the PECM between internal and external in both quadrants for low and high controls. This reflects the fact that these specific initiatives contained both internal and external participants providing solutions.

## **B. Measuring Controls**

At the lowest level within crowd initiatives many examples feature general privacy and data protection assurances followed by general terms and conditions for participation. A low level of control and regulation is required in these initiatives. This is followed by initiatives that have a high level of legal and financial regulation whereby members of the crowd expressly consent and agree to legal agreements in participating. These agreements can range from consenting to participation rules, financial agreements, all the way towards express consent to intellectual property ownership. At the highest level within the categorisation we see extensive commitments provided by crowd members in lieu of participation. Examples of this heavily regulated approach identified in this research include the execution of non-disclosure agreements, licences, financial payments, substantial contractual commitments and consent to state security regulations. These high levels of controls are also present in traditional scientific research funding calls. In public initiatives operated by academics and industry experts we generally see high levels of regulation. An example of these regulations in a traditional context is the US Federal Advisory Committee Act (FACA) (O'Reilly, 2011, Margetts, 2011). Many public crowd initiatives do not show governments seeking to retain control of the intellectual property or ownership of the process outputs. However, other types of strict controls in relation to funding are clearly in place in traditional call systems. For universities, intellectual property issues are of great significance (Villasenor, 2012). This compares to private crowd initiatives where private equities are often at stake and substantial financial controls are in place. Restrictions in relation to nationality have been disregarded from the matrix based upon the fact that nationality merely defines a geographical territory and offers no criteria upon which reasonable distinctions can be drawn for the purposes of categorisation. Likewise participant's age and skill have been disregarded from the categorisation criteria based upon the fact that in certain types of scientific project, neither minimum age nor a minimum skill level are required. This is in contrast to openness and control criteria, which are measures present in all of the entities surveyed.

## 10. Results

There are numerous advantages to calling upon the crowd over traditional call systems used by SRFA's. Firstly, greater transparency is afforded to participants. In any political system where the means of assessment is a "black box" scenario this can lead to mistrust amongst participants. The use of the internet by government has impacted citizens (Margetts, 2011). This use of web platforms provides citizens with greater transparency. With a crowd process all aspects of the selection process and voting criteria are transparent offering participants a greater level of confidence in the process. Secondly, other actors can jointly participate in process patronage. Larger institutions become involved in nurturing smaller institutions and research centres, thereby indirectly generating external and open research clusters. Thirdly, the cost of the employment of specific experts to manage the traditional call process is reduced whereby the crowd assumes responsibility for the construction, vetting and selection process that takes place throughout the open call. Though a desire to maintain the open crowd facilitated process the crowd in-turn reduce administration costs for the SRFA. Lastly, a greater potential for repeat crowd participation occurs. Research has shown in crowdsourcing that the more a candidate wins the more likely they are to continue (Yang et al., 2008). Accordingly, repeat engagement provides better results.

The process of crowd engagement has presented dynamic solutions to problems not available under more traditional systems. Examples are available of where the crowd can be used to self assemble, select the problem to be addressed and identify the best solution. One such example of community crowdsourcing is the 3d environment Second Life (Llewelyn, 2006). It is through this dynamic set of interactions amongst the crowd members that dynamic solutions are attained. Crowdsourcing and crowdfunding in the traditional sense have an extremely broad reach where anyone in the crowd can make suggestions or become involved. Indeed research has shown that a high number of solutions attained in some competitions are provided by crowd members not from a particular discipline or indeed not from the initiator's geographical area (Boudreau and Lakhani, 2013). The true merit in crowd engagement comes from the myriad of potential solutions that can arise from the broad size and diverse skillset presented by a crowd. Within this crowd the citizen scientist and citizen funder can drive innovation and economic growth for governments.

## Crowd Entities - Preliminary Entity Categorisation Matrix

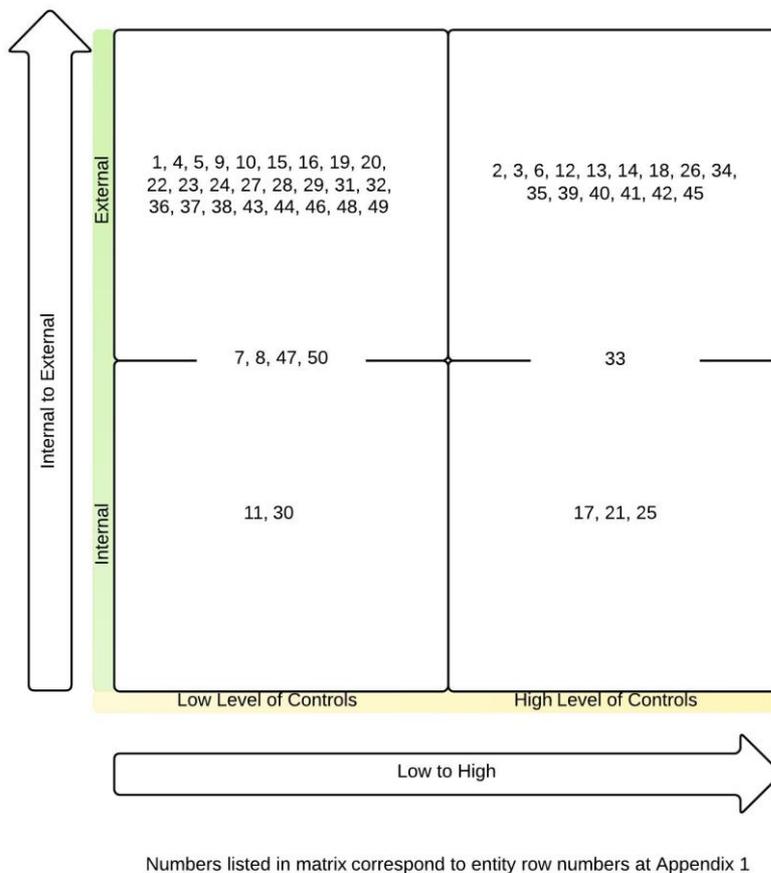


Fig 1. Preliminary Entity Categorisation Matrix

## 11. Conclusion

This research in progress brings with it various implications for practice. Firstly, government bodies will be able to identify similar entities using crowd through the criteria advanced. Secondly, a custom crowd model can be created for SRFA's. In identifying similar users of the crowd, the constructs that are required to form a preliminary model can be identified most suited to the needs of the triple helix relationships. It will also enable the identification of factors relevant to improving and transforming crowd initiatives so as to make the process more open and more engaging. Future research will seek to identify instances of crowd formation, problem specification and solution specification within crowd processes used by entities similar to SRFA's located in the PECM. From this piece of research we have learned of the similarities and differences that exist between the various types of entities engaging the crowd. It is evident that with high levels of regulation and moderate to low levels of openness, SRFA's inhabit an area towards the bottom right of the matrix. An efficient crowd enabled process will ideally move towards the top left quadrant with a greater degree of citizen involvement and the removal of regulation barriers to enable participation.

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**Appendix 1.**

	<b>Entity Name</b>	<b>URL</b>	<b>Openness</b>	<b>Crowd Limits</b>	<b>Control</b>	<b>Entity</b>	<b>Crowd Type</b>
<b>1</b>	Virtual Student Foreign Service	<a href="http://www.state.gov/vsfs/">http://www.state.gov/vsfs/</a>	Ext	Yes	Low	Gov	CS
<b>2</b>	Imagery to the Crowd	<a href="https://hiu.state.gov/itc/itc.aspx">https://hiu.state.gov/itc/itc.aspx</a>	Ext	No	High	Gov	CS
<b>3</b>	Bureau of Arms Control	<a href="http://www.state.gov/t/avc/innovationcompetition/">http://www.state.gov/t/avc/innovationcompetition/</a>	Ext	Yes	High	Gov	CS
<b>4</b>	MapGive - Humanitarian Information Unit	<a href="http://mapgive.state.gov/">http://mapgive.state.gov/</a>	Ext	No	Low	Org	CS
<b>5</b>	OpenStreetMap	<a href="https://www.openstreetmap.org/">https://www.openstreetmap.org/</a>	Ext	No	Low	Org	CS
<b>6</b>	Alumni Enagement and Innovation Fund	<a href="http://www.rockethub.com/projects/partner/socialimpact">http://www.rockethub.com/projects/partner/socialimpact</a>	Ext	No	High	Gov	CF
<b>7</b>	State Dept Github	<a href="https://github.com/USStateDept">https://github.com/USStateDept</a>	Int & Ext	No	Low	Gov	CS
<b>8</b>	Patient Feedback Challenge	<a href="http://pfchallenge.clearvale.com/">http://pfchallenge.clearvale.com/</a>	Int & Ext	Yes	Low	Gov	CS
<b>9</b>	Foreign & Commonwealth Office Digital Diplomacy	<a href="http://blogs.fco.gov.uk/digitaldiplomacy/case-studies/?studytype=formulating-policy">http://blogs.fco.gov.uk/digitaldiplomacy/case-studies/?studytype=formulating-policy</a>	Ext	No	Low	Gov	CS
<b>10</b>	Open Ministry Crowdsourcing Legislation	<a href="http://openministry.info/">http://openministry.info/</a>	Ext	Yes	Low	Org	CS
<b>11</b>	Blueprint 2020	<a href="http://www.clerk.gc.ca/eng/feature.asp?pageld=349">http://www.clerk.gc.ca/eng/feature.asp?pageld=349</a>	Int	Yes	Low	Gov	CS
<b>12</b>	Citizeninvestor	<a href="http://www.citizeninvestor.com/">http://www.citizeninvestor.com/</a>	Ext	No	High	Co	CF
<b>13</b>	Neighbour.ly	<a href="http://www.neighbor.ly">http://www.neighbor.ly</a>	Ext	Yes	High	Co	CF
<b>14</b>	Voordekunst	<a href="http://www.voordekunst.nl">http://www.voordekunst.nl</a>	Ext	No	High	Org	CF
<b>15</b>	Joukkoenkel	<a href="http://www.joukkoenkeli.fi">http://www.joukkoenkeli.fi</a>	Ext	No	Low	Co	CS
<b>16</b>	Change by us	<a href="http://nyc.changeby.us/">http://nyc.changeby.us/</a>	Ext	No	Low	Gov Org	CS
<b>17</b>	Mayors Office New York	<a href="https://Spigit.com">https://Spigit.com</a>	Int	Yes	High	Gov	CS

18	Neighbourhood matching fund	<a href="http://www.seattle.gov/neighborhoods/nmf/">http://www.seattle.gov/neighborhoods/nmf/</a>	Ext	Yes	High	Gov	CF
19	Otakantaa.fi	<a href="http://www.otakantaa.fi">http://www.otakantaa.fi</a>	Ext	No	Low	Gov	CS
20	Kansalaisaloite.fi	<a href="http://kansalaisaloite.fi">http://kansalaisaloite.fi</a>	Ext	No	Low	Gov	CS
21	HHS Idea Lab	<a href="http://www.hhs.gov/idealab/i-want-support/for-hhs-2/">http://www.hhs.gov/idealab/i-want-support/for-hhs-2/</a>	Int	Yes	High	Gov	CF
22	Osallistuva budjetointi	<a href="http://www.osallistuvabudjetointi.fi">http://www.osallistuvabudjetointi.fi</a>	Ext	No	Low	Gov	CS
23	European Commission	<a href="http://ec.europa.eu/internal_market/consultations/2013/crowdfunding/index_en.htm">http://ec.europa.eu/internal_market/consultations/2013/crowdfunding/index_en.htm</a>	Ext	No	Low	Gov	CS
24	Speak Up Austin	<a href="http://speakupaustin.org/ideas">http://speakupaustin.org/ideas</a>	Ext	No	Low	Gov	CS
25	USN RAD (Reducing Administrative Distractions)	<a href="http://ideascale.com/">http://ideascale.com/</a>	Int	Yes	High	Gov	CS
26	USAF Vehicle Stopper	<a href="https://www.innocentive.com/ar/challenge/9932698">https://www.innocentive.com/ar/challenge/9932698</a>	Ext	Yes	High	Co Gov	CS
27	Charter 12	<a href="http://petitsioon.ee/harta12">http://petitsioon.ee/harta12</a>	Ext	No	Low	Org	CS
28	E-petitions	<a href="http://www.direct.gov.uk/e-petitions">www.direct.gov.uk/e-petitions</a>	Ext	Yes	Low	Gov	CS
29	We The People	<a href="https://petitions.whitehouse.gov/">https://petitions.whitehouse.gov/</a>	Ext	Yes	Low	Gov	CS
30	Pirate Party	<a href="http://liquidfeedback.org/">http://liquidfeedback.org/</a>	Int	Yes	Low	Org	CS
31	Future Melbourne	<a href="http://www.futuremelbourne.com.au/wiki/view/FMPlan">http://www.futuremelbourne.com.au/wiki/view/FMPlan</a>	Ext	No	Low	Gov	CS
32	Fix My Street	<a href="http://www.fixmystreet.com/">http://www.fixmystreet.com/</a>	Ext	No	Low	Org	CS
33	UC-Crowd Challenge Acad	<a href="http://uc-crowd.iscte-iul.pt/">http://uc-crowd.iscte-iul.pt/</a>	Int & Ext	Yes	High	Gov	CS
34	MIT Climate Colab	<a href="http://climatecolab.org">http://climatecolab.org</a>	Ext	No	High	Acad Org	CS
35	Cairo Transport App	<a href="http://cairo.hackathome.com">http://cairo.hackathome.com</a>	Ext	No	High	Acad Gov Co	CS

36	UN My World	<a href="http://worldwewant2015.org">http://worldwewant2015.org</a>	Ext	No	Low	Org	CS
37	UNHCR Innovate	<a href="http://www.unhcrinnovation.org/">http://www.unhcrinnovation.org/</a>	Ext	No	Low	Org	CS
38	UNDP Eurasia	<a href="http://dynamicdemand.nesta.org.uk">http://dynamicdemand.nesta.org.uk</a>	Ext	No	Low	Org	CS
39	ITU Young Innovators	<a href="http://ideas.itu.int">http://ideas.itu.int</a>	Ext	Yes	High	Co	CS
40	Dell Social Innovation Challenge	<a href="http://www.dell.com/learn/us/en/uscorp1/corp-comm/cr-social-innovation-competition">http://www.dell.com/learn/us/en/uscorp1/corp-comm/cr-social-innovation-competition</a>	Ext	No	High	Co	CS CF
41	Start Some Good	<a href="http://startsomegood.com/">http://startsomegood.com/</a>	Ext	No	High	Co	CF
42	Ushahidi Crowdmap	<a href="http://www.ushahidi.com/blog/product/crowdmap/">http://www.ushahidi.com/blog/product/crowdmap/</a>	Ext	No	High	Co Org	CS
43	Smithsonian Transcription	<a href="https://transcription.si.edu/">https://transcription.si.edu/</a>	Ext	No	Low	Gov	CS
44	Open IDEO	<a href="https://openideo.com/challenge">https://openideo.com/challenge</a>	Ext	No	Low	Org	CS
45	Innovation Exchange Challenges	<a href="http://www.innovationexchange.com/open-challenges.aspx">http://www.innovationexchange.com/open-challenges.aspx</a>	Ext	No	High	Co Org	CS
46	Fold It	<a href="http://fold.it">http://fold.it</a>	Ext	No	Low	Org	CS
47	EteRNA	<a href="http://eterna.cmu.edu/web/">http://eterna.cmu.edu/web/</a>	Int & Ext	No	Low	Org	CS
48	Micropasts: Crowdsourcing	<a href="http://crowdsourced.micropasts.org/">http://crowdsourced.micropasts.org/</a>	Ext	No	Low	Org	CS CF
49	Eye Wire	<a href="https://eyewire.org/">https://eyewire.org/</a>	Ext	No	Low	Acad	CS
50	Cities at Night	<a href="http://www.citiesatnight.org/">http://www.citiesatnight.org/</a>	Int & Ext	No	Low	Org	CS

Legend;

Openness = Whether or not the initiative is internal or external to the initiator

Crowd Limits = Whether or not membership of the crowd is limited by criteria

Control = Whether or not a low or high amount of controls are in place

Entity = **G**overnment, **O**rganisation, **B**ody **C**orporate, **A**cademic Institution

Crowd Type = Crowdsourcing **CS**, Crowdfunding **CF**