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Article in *Journal of Innovation Management* · October 2015

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Wisdom-of-the-crowds to enhance innovation: state of the art

Irina Saur-Amaral

Universidade Europeia, Lisboa, Portugal
irina.amaral@europeia.pt

Abstract. Our paper performs a systematic literature review on academic and non-academic studies on “wisdom of the crowds” or “collective intelligence” and its possible usage to enhance innovation, with or without financial compensation for the member of the crowd. We aggregate and critically compare contributions since 2004, when the concept was coined, in a conceptual framework meant to assist innovation professionals in sourcing various types of knowledge from the crowds. Key dimensions point towards different approaches according to the type of information/knowledge required, different types of target-crowd, according to company goals and phase of innovation process where knowledge is to be used.

Keywords. Costumer, Consumer Behavior, Consumer Information, Consumer Co-creation, Online Community, Wisdom of Crowds, Crowdsourcing, Collaboration, Social Computing, Information Medium, Knowledge Management.

1 Introduction

In the last decade, organizations have increasingly looked into knowledge sourcing, preferably for free, from online communities e.g. social networks, discussion groups and blogs (Brabham, 2012; Haythornthwaite, 2009; Kang and Kang, 2010; Saur-Amaral and Amaral, 2010; Saur-Amaral and Rego, 2010; Tödtling et al., 2011; Yue and Blevis, 2011).

There are still debates on the potential value of the knowledge obtained using this means and whether it should be used in the innovation process (Baumoel et al., 2009; Buggie, 2007; Ebner et al., 2008; Nishida, 2011; Saur-Amaral and Rego, 2010) and we find different types of crowds act in different ways for different purposes (Brabham, 2012; Buggie, 2007; Hill and Ready-Campbell, 2011; Wagner et al., 2010; Welinder et al., 2010).

The main goal of our study is the development of a conceptual model showing how can the wisdom of the crowds be used to enhance organizational innovation, at what level of the organizational innovation (process, project, product/service and overall strategy) and according to what type of knowledge. We build a framework that can be used to strategically map the possible alternatives and to draw operational schemes to implement crowdsourcing initiatives.

To build the conceptual model, we perform a systematic literature review around the concept of crowdsourcing for innovation (Ebner et al., 2008; Saur-Amaral and Rego, 2010), using published scientific work to look back into the past, and discussion/opinion scientific and non-scientific work to look into the future. We draw our data from four databases: Google Scholar, ISI Current Contents, Scopus and ABI inform.

We critically compare and aggregate existing contributions from scientific journals, proceedings, opinion journals and discussion papers, between 2004 to April 2012, to

create a knowledge base on collective intelligence/“wisdom of the crowds” usage for innovation, a framework to assist innovation professionals and scholars interested in further studying the concept. This framework is developed using content analysis of abstracts and a selection of full-texts and supported by plain bibliometric analysis of key publications and authors.

Our paper starts with the methodology chapter, where we plan the systematic literature review in all its dimensions. Next, we present a synthetic view of expected scientific knowledge on the topic and develop the review protocol. After that, we present the data collection and results. We subsequently develop the conceptual framework and support it with explanatory description of key dimensions and respective citations, to allow its application in further studies.

2 Methodology

The achievement of our research goal requires searching, filtering and analyzing a large number of publications related to wisdom of crowds and its role in organizational innovation. This is a research task to be performed in the methodological underpinning of literature reviews and conceptual model building.

In the latest decade, there has been quite a large number of academic studies focusing on meta-analyses, systematic literature reviews, structured literature reviews and so on (Briner and Denyer, 2012; Crossan and Apaydin, 2010; Denyer and Tranfield, 2009; Kofinas and Saur-Amaral, 2008; Pittaway and Cope, 2007; Saur-Amaral and Amaral, 2010; Walker, 2010).

However, researchers tend to use informal and unstructured processes to review literatures and decide upon the key areas to research (Tranfield et al., 2003, see Table 1, page 213, for a very detailed perspective over the process), which necessarily leads to an incomplete process of identification of scientific school of thought and to low efficiency in the research process (Kofinas and Saur-Amaral, 2008; Saur-Amaral, 2010; Saur-Amaral, 2011). Systematic literature reviews are a systematic approach, with specific methodological concerns, which allow us to overcome this limitation.

In social sciences, the first adaptation of systematic literature reviews was done in 2002 and 2003 (Tranfield et al., 2003; Tranfield and Mouchel, 2002). Tranfield and his colleagues proposed that systematic reviews should be used to develop decision-making evidence databases for managers, so as to overcome the typical unsystematic, informal and unconditioned process of literature review and to identify key areas to research. They suggested the methodological approach presented in Table 1.

Table 1. How to perform a systematic literature review (synthesis of approach suggested by Tranfield et al., 2003).

Steps	Methodological concerns
Planning the review: <ul style="list-style-type: none"> • Why do a review? • Prepare review proposal • Develop a review protocol 	<p>May require previous studies to better understand the field and identify alternative ways on how the topic has been previously addressed</p> <p>The review protocol should contain a conceptual discussion of research problem.</p> <p>Keywords and search terms should be identified.</p>
Conducting the review: <ul style="list-style-type: none"> • Identify research • Select studies • Assess their quality 	<p>Should be a comprehensive, unbiased search, rigorously applying the review protocol and the inclusion/exclusion criteria.</p> <p>Search should be reported in sufficient detail to ensure replicability.</p>

<ul style="list-style-type: none"> • Extract data • Synthesize data 	<p>Disagreement between reviewers should be explained and consensus should be reached.</p> <p>The output of the search should be the full list of relevant results.</p>
<p>Reporting and dissemination:</p> <ul style="list-style-type: none"> • Developing the report • Dissemination into practice 	<p>Should be clear and effective.</p> <p>Two types of reports can be produced: descriptive analysis of all results (most relevant authors, journals etc.) and thematic analysis (emergent themes and research questions)</p>

In our research, we apply the three steps of the systematic literature reviews, considering the experience of previous studies (Briner and Denyer, 2012; Crossan and Apaydin, 2010; Denyer and Tranfield, 2009; Kofinas and Saur-Amaral, 2008; Saur-Amaral and Amaral, 2010; Walker, 2010).

We first study the concept and then build the review protocol, based on keywords, previously used by other authors. We rigorously perform the search according to the review protocol and we record all the steps and justify decisions, ensuring transparency and replicability of the study. We extract records to Endnote X5, where we perform the preliminary relevance selection and we export relevant records to xml and then import into NVivo 9.

We perform content analysis in NVivo, using as orientation framework the keywords and the previous knowledge on the concept, yet drawing on categories building in a grounded-theory approach (Charmaz, 2006), following the three coding phases. We use coding queries and cluster diagrams to explore and test results and we extract information via reports and specific matrix-coding queries, to support categories with specific number of references and citations. Descriptive data for generic and thematic statistical analysis is drawn from the classification sheet and imported in SPSS.

The conceptual model is built upon the data obtained from content analysis and explanatory description of each component is supported by citations and references obtained from NVivo analysis.

3 Wisdom of Crowds, Crowdsourcing and Innovation

3.1 What Is Wisdom of Crowds?

James Surowiecki (2005) coined the term "wisdom of crowds" to refer to the frequent superiority of groups over individuals in predicting public opinion:

"individual irrational acts [...] can produce collectively rational outcomes" (Surowiecki, 2005, p. 116)

"experiments showed that [...] even imperfect markets populated by imperfect people could still produce near ideal results" (Surowiecki, 2005, p. 103)

While this is part of a philosophical debate (Solomon, 2006), several studies have proven that group judgment and group decision has tendentially proven superior to individual judgment and decision, as individuals adhere and are influenced by their group (Buggie, 2007; Duboff, 2007; Ebner et al., 2008; Herzog and Hertwig, 2011; Hill and Ready-Campbell, 2011; Kittur and Kraut, 2008; Kozinets et al., 2008; Lopez et al., 2009; Mayo-Wilson et al., 2010; Ray, 2006).

Public opinion polls have been used by politicians to predict events, crowds of financial experts have been used to develop prediction markets able to estimate e.g.

evolution of future markets (Hill and Ready-Campbell, 2011; Ray, 2006)

3.2 How Do We Source Crowds?

The crowdsourcing concept is recent and emerges from practice. Howe (2006) introduces this concept as a way of using the crowd (people in general, unlinked to any specific organization and unrelated to any organizational hierarchy) as a content/knowledge producer. Several authors relate crowdsourcing to web 2.0 potential to obtain contributions from lots of people on a given issue (Bonabeau, 2009; Hudson-Smith et al., 2009; Leimeister et al., 2009; Vojnovic and Dipalantino, 2010; Vukovic, 2009).

We define crowdsourcing as a set of methods/techniques typically supported by web-based technologies, used to obtain low-cost external contributions (i.e. source external knowledge) potentially useful for an organization, from a large number of individuals. This is the operational definition we assume in our paper.

There are four types of crowdsourcing activities:

- Crowd wisdom (CW) – using knowledge and information outside the organization to help with decision-making, predict markets or perform specific tasks (Dahlander and Magnusson, 2008; Howe, 2008; Jouret, 2009; Leimeister et al., 2009; Thayer, 2001; Thayer, 2006)
- Crowd creation (CC) – generating content and valuing it (Almeida et al., 2010; Bernoff and Li, 2008; Buckley and Giannakopoulos, 2010; Han, 2010; Howe, 2008; Huberman et al., 2009; Kho, 2006)
- Crowd voting (CV) – filtering and ranking online content (Howe, 2008; Liu et al., 2008; Park and Pennock, 2007)
- Crowd funding (CF) – capacity of the crowd to finance specific activities or a specific project (Howe, 2008; Kiva, 2011; Levenshus, 2010; Lipton, 2009).

Sourcing crowds has been approached differently, whether applied in offline, or online media. The most known technique to source the wisdom of the crowd in offline environment is Delphi (Buggie, 2007; Duboff, 2007), used to define future scenarios and draw technological roadmaps, i.e. used for medium-and long-term forecasting.

In online media, academic studies have focused on crowdsourcing and open source initiatives, considered to be related to organizational innovation processes (Ebner et al., 2008; Muhdi et al., 2010; Saur-Amaral and Rego, 2010). Crowdcreation has been used in open or closed wiki spaces or online game platforms (like Second Life some years ago) to identify directions of new product development and help customizing new products.

Online Crowdsourcing (which is the focus of our paper) is usually supported by Internet-based technological platforms (Cummings et al., 2010; Muhdi et al., 2010; Santonen and Lehtelä, 2010; Saur-Amaral and Rego, 2010), yet the usage of social networks as technological platforms for crowdsourcing is still in its infancy (Saur-Amaral and Rego, 2010).

3.3 What is the Link between Crowdsourcing and Innovation?

Crowdsourcing is only one of different techniques used to source external knowledge for innovation and it may be limited to the type of knowledge it can obtain.

As Kang and Kang (2010) argue, if based on social networks, it has low cost, but has as disadvantage a “relatively invaluable knowledge transfer”, as it is focused on information sharing and not on “critical capability sharing” (Granovetter, 1973; Hansen, 1999, cit. in Kang and Kang, 2010, page 5).

More recent studies argue that there is capability sharing in social networks, due to the development of shared empathy spaces in online networks where professionals share critical knowledge as part of a community of practice (Saur-Amaral et al., 2011; Saur-Amaral and Rego, 2010).

Few usages of crowdsourcing for R&D or innovation in organizations have already been pointed by literature: solving concrete issues in the R&D/innovation processes and helping R&D/innovation managers to better integrate information/knowledge (Becker, 2011; Bonabeau, 2009; Cummings et al., 2010; Howe, 2006; Howe, 2008; Hudson-Smith et al., 2009; Leimeister et al., 2009; Santonen and Lehtelä, 2010; Saur-Amaral and Rego, 2010; Vojnovic and Dipalantino, 2010; Vukovic, 2009) – see Table 2.

We use this knowledge as a starting point for our systematic literature review, in the next section.

Table 2. Main benefits of crowdsourcing for R&D/innovation managers.

<i>Focus</i>	<i>Benefit</i>	<i>Reference</i>	<i>Crowdsourcing Type</i>
R&D	Problem identification	(Cummings et al., 2010)	CW, CC, CV
	Idea generation	(Muhdi et al., 2010 ; Santonen and Lehtelä, 2010)	CC
	Idea debate/development	(Saur-Amaral and Rego, 2010)	CW, CC
	Personalized interaction with and feedback from users	(Whitla, 2009)	CW, CC, CV
	Problem-solving	(Saur-Amaral and Rego, 2010)	CW
	Integration of disperse knowledge (better knowledge brokers and project managers)	(Becker, 2011)	CW, CC
MARKET / STRATEGY	Future scenario development	(Saur-Amaral and Rego, 2010)	CC, CW
	Opening markets and creating new market share	(Whitla, 2009)	N/A
	Advertising and promotion activities	(Whitla, 2009)	N/A

4 Systematic Literature Review: Crowdsourcing for innovation

4.1 Planning and Data Collection

We first filled in the review protocol (see Appendix). Next, we collected data, independently in each database, and results as shown in Table 3 and the final list of results imported in Endnote had 37 papers.

Table 3. Overview of data collection in the three databases and Google Scholar.

<i>Database</i>	<i>Number of results</i>	<i>Citations</i>	<i>Duplicates</i>
ISI Current Contents	6	(Bogers and West, 2012; Ebner et al., 2009a; Hutter et al., 2011; Jashapara, 2007; Nam, 2012; Reissberg, 2011a)	Ebner et al., 2009; Nam, 2012; Reissberg, 2011
Scopus	8	(Brabham, 2008; Chanal and Caron-Fasan, 2010; Ebner et al., 2009c; Nam, 2012; Reissberg, 2011a; Saur-Amaral and Rego, 2010; Schweisfurth et al., 2011a; Wexler, 2011b)	Ebner et al., 2009; Nam, 2012; Reissberg, 2011; Schweisfurth et al., 2011; Wexler, 2011
ABI Inform	7	(Datta, 2008; Ebner et al., 2009b; Hempel, 2006; Potter, 2010; Reissberg, 2011b; Schweisfurth et al., 2011b; Wexler, 2011a)	Ebner et al., 2009; Reissberg, 2011; Schweisfurth et al., 2011; Wexler, 2011
Google Scholar	23 (first five pages)	(Antikainen et al., 2010; Albors et al., 2008; Andersson, 2009; Battistella and Nonino, 2012; Bayus, 2013; Bonabeau, 2009; Elmquist et al., 2009; Enkel et al., 2009; Ghafele and Gibert, 2011; Haller et al., 2011; Huberman et al., 2009; İren and Bilgen, 2012; Leimeister, 2010; Leimeister et al., 2009; Littlejohn et al., 2012; Luo et al., 2009; Malone, 2008; Malone et al., 2009; Riedl et al., 2010; Schaffers et al., 2011; Schenk and Guittard, 2009; Tzeng, 2009; Yang, 2012)	n.a.
All no duplicates	37	(Antikainen et al., 2010; Albors et al., 2008; Andersson, 2009; Battistella and Nonino, 2012; Bayus, 2013; Bogers and West, 2012; Bonabeau, 2009; Brabham, 2008; Chanal and Caron-Fasan, 2010; Datta, 2008; Ebner et al., 2009c; Elmquist et al., 2009; Enkel et al., 2009; Ghafele and Gibert, 2011; Haller et al., 2011; Hempel, 2006; Huberman et al., 2009; Hutter et al., 2011; İren and Bilgen, 2012; Jashapara, 2007; Leimeister, 2010; Leimeister et al., 2009; Littlejohn et al., 2012; Luo et al., 2009; Malone, 2008; Malone et al., 2009; Nam, 2012; Potter, 2010; Reissberg, 2011a; Riedl et al., 2010; Saur-Amaral and Rego, 2010; Schaffers et al., 2011; Schenk and Guittard, 2009; Schweisfurth et al., 2011a; Tzeng, 2009; Wexler, 2011b; Yang, 2012)	n.a.

Source: author compilation

After successful importation and elimination of duplicates, we performed a relevance selection, based on abstracts, for those results that came from the three scientific-

oriented databases (ISI Current Contents, Scopus and ABI Inform). All records had abstracts in English and a brief analysis proved them to be potentially useful for the research.

For all these records, as well as, records obtained from Google Scholar, we went to obtain Full Text. Out of all records, for two of them we could not obtain full text (Malone, 2008; Schweisfurth et al., 2011a). (Malone, 2008) was eliminated from the results, as it came from Google Scholar and had no abstract, so we could not analyze it in the thematic analysis. We kept (Schweisfurth et al., 2011), which had a relevant abstract obtained from Scopus and ABI Inform.

Our list of results went thus down to 36 results, out of which 35 with abstract and full text, and 1 with abstract only. Next, we created the xml file for importation in NVivo, where all 36 results were imported.

4.2 Results: Descriptive statistics and Thematic Analysis

We first filled in the review protocol (see Appendix 1). Next, we collected data, independently in each database, and results as shown in Table 3 and the final list of results imported in Endnote had 36 papers.

We performed descriptive statistics on authors, publication years and publication names. From a total of 78 authors and co-authors, only two authors had more than one publication:

- Jan Marco Leimeister, 3 papers;
- Helmut Krcmar, 2 papers

In terms of publication years, as it can be observed in Figure 1, there has been an increase in 2009, however decreasing in the late years.

While the number in 2012 is apparently low, we need to take into account that the data collection was performed in May 2012 and also that it is higher than 2008. Nonetheless, 2009, with 11 publications, is the most represented in our sample (30%).

Regarding publications, there is no particular leader, from all 22 scientific publications, only three of them published more than one paper:

- Business & Information Systems Engineering (2 papers)
- International Journal of Technology Intelligence and Planning (2 papers)
- R and D Management (2 papers)

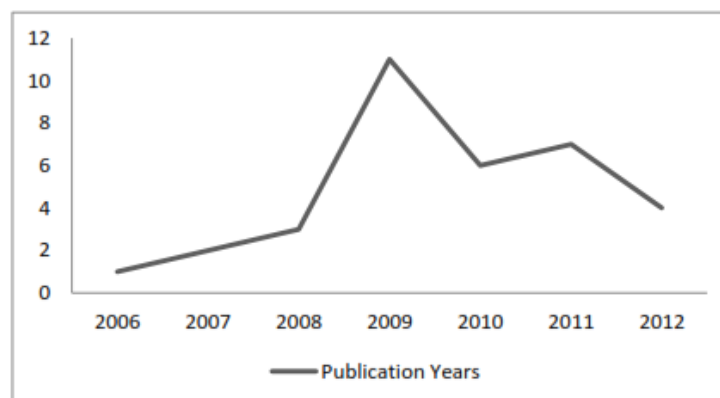


Fig. 1. Yearly distribution of publications in our sample.

Source	Percentage
A : ISI	8%
B : ISI+PROQUEST+SCOPUS	8%
C : ISI+SCOPUS	6%
D : PROQUEST	6%
E : Scholar only	63%
F : SCOPUS	6%
G : SCOPUS+PROQUEST	3%

Fig. 2. Distribution of publications per origin.

[illegible]

Fig. 3. Word Frequency Maps (Tag Clouds) for Keywords (LEFT) and Abstracts (RIGHT) in Our Sample.

The abstracts give more emphasis to models, research and processes, together with crowd(s) and research, while keywords emphasize more words like virtual, software and source, together with information and networks.

The manual coding complemented this perspective.

A first overlook to the main research questions (see Table 4) linked to crowdsourcing

revealed that most questions were exploratory, trying to comprehend the motivations of crowdsourcees to collaborate in crowdsourcing initiatives, the structure and management of different type of communities for crowdsourcing, as well as trying to look at crowdsourcing from an organizational strategic perspective, developing goals and appropriate implementation tools and management practices and debating intellectual properties issues.

Table 4. Sample of Research Questions on Crowdsourcing.

<i>Research question</i>	<i>Authors</i>
“How can users be motivated to collaborate in OI communities? What kind of tools and methods can support collaboration in OI communities?”	(Antikainen et al., 2010, page 100)
What is “the nature of an individual’s ideation efforts in a crowdsourcing community over time”? Do “ideators with past success in proposing ideas that are implemented continue to generate the types of ideas an organization desires to implement?”	(Bayus, 2010, page 227)
“What are the main strategic difficulties encountered by firms whose business models rely on public web communities to create value?”	(Chanal et al., 2010, page 318)
“How to find and lever the enormous potential of the ‘collective brain’ to broaden the scope of ‘open R&D’?”	(Ebner et al., 2009, page 1)
“Examine the manner in which advocates of crowdsourcing reconfigure the classical sociological treatment of the crowd”	(Wexler, 2011, page 6)

Methodological approaches naturally follow the exploratory nature of the research questions, focusing on case-based reasoning and panel data analysis for specific communities designed for crowdsourcing.

The most frequent cases mentioned as examples or used as object of study go around classical Innocentive, IdeaStorm, Threadless, iStockphoto, NineSigma, Yet2Com, Goldcorp, yet less famous names appeared, too (e.g. Crowdspirit, SAPIens, Innovation Jam, Syntegration, innerTee, Bookmooch). However, new platforms continue to emerge, thus names may lose popularity after a while, what is important is the concept, the way of interaction with the crowd and crowdsourcee-to-crowdsourcee and the way it is managed.

Crowds are different. Specialist crowds with little interaction are different than generalist crowds with lot of interaction and collective intelligence concept applies differently in those types of crowds. Bonabeau (2009, page 51) has an interesting table arguing towards this idea.

Therefore, the expected contributions in the case of crowdsourcing in these crowds are also expected to be different (e.g. idea sourcing from generalist crowds may be used to discover different concepts or identify problems that need to be solved, while idea sourcing from specialist crowds may be used for problem solving or for the development of technical solutions of technical feedback during the process).

Therefore, appropriate toolkits to tap into community/collective knowledge/wisdom may also be different (Antikainen et al., 2010).

A large number of publications look into motivations of participants in crowdsourcing initiatives, in free or paid contributions environment. Figure 4 presents the key motivations encountered during coding.

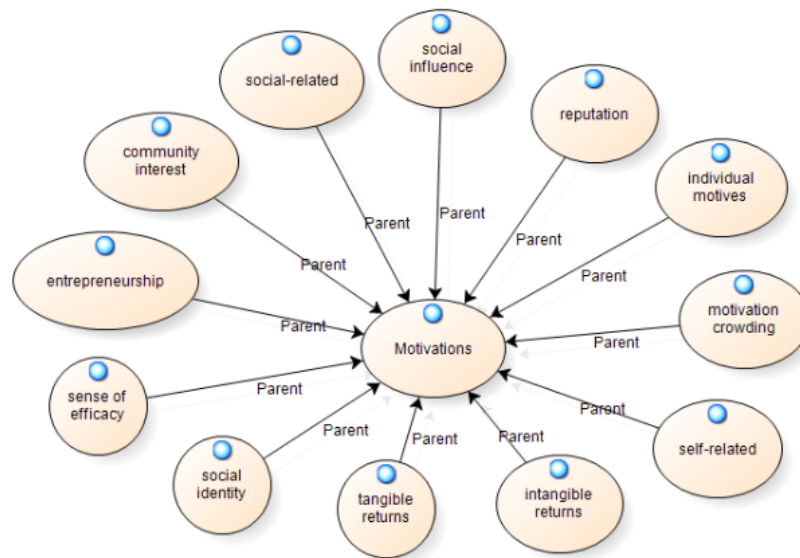


Fig. 4. Overview of Participants' Motivations for Crowdsourcing.

The most frequently studied and mentioned are motives related to individual interest in participating in the crowdsourcing initiatives, reputation, social-related (e.g. integration in a community) reasons and also the possibility to receive tangible returns from their contributions (e.g. financial rewards, employment).

However, one aspect worth mentioning with practical implication for management is that each community is a community and members react to different motives. It is highly desirable to somehow inquire members, so as, to what type of benefit would they expect for their contributions.

Care should be taken in future research as motivations for open source communities, for example, are expected to be different in organizational co-creation communities, yet similar in open social networks like Facebook or LinkedIn.

A related future direction for research would be inquiring individuals that are potential or past crowdsourcers to identify what are the motivations behind their contribution in each type of community/crowd. There is very limited existing research in this field of studies.

Another large number of publications looks into organizational implications of crowdsourcing initiatives, presented in Figure 5.

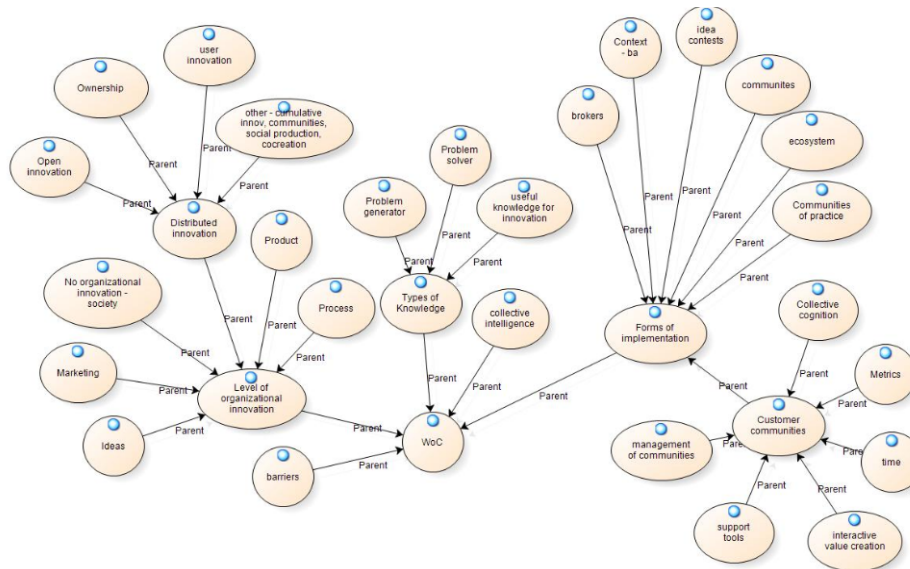


Fig. 5. Overview of Crowdsourcing: Exploratory Model.

Not all crowdsourcing initiatives are used for organizational innovation. Initiatives, which benefit society as a whole or have specific social impact are specific, e.g. citizen-sourcing suggested by Nam (2012, page 12): “citizen-sourcing initiatives: purpose (image-making or ideation), collective intelligence type (professional knowledge or innovative ideas), and strategy (contest, wiki, social networking, or social voting)”.

When used for organizational innovation, crowd knowledge/information is typically used to generate ideas or to improve/develop new products.

A related concept is ‘distributed innovation’ i.e. the capacity to “manage knowledge in a distributed form, sharing knowledge and collaborating beyond the limits of their organizations” (Hildreth et al., 2000, cited in Albors et al., 2008, page 197), which includes three different approaches: user innovation (von Hippel, 1976; 1988; 2005), open innovation (Chesbrough, 2003; 2006) and cumulative innovation, communities, social production and co-creation (Benkler, 2006; Bogers et al., 2010; Murray and O’Mahony, 2007; West and Lakhani, 2008).

Regarding the way to implement crowdsourcing initiatives, we see the importance of understanding the communities, their contexts (Ba and democratization) and their participants and, above all, to see the crowds as ecosystems¹, where brokers and opinion makers (Ahonen and Lietsala, 2007; Antikainen et al., 2010; Chanal and Caron-Fasan, 2010; Kozinets, et al., 2008) play key roles.

Collective cognition processes go around the four types of social interaction suggested by Hargadon and Bechky (2006, pages 489 to 490), i.e. “help seeking, help giving, reflective reframing and reinforcing”.

So, organizations may choose where they want to position and prepare their

¹ We suggest to go beyond the known definition i.e. “an ecological system of factors which can be denominated the learning organization” (Albors et al., 2008), and to see the crowd interacting with other crowds and various organizations, in a networked environment.

intervention, either through a visible branded action (e.g. idea contest, developing a specific community of users), or through a more discrete approach, using their employees or specific contracted specialists, to present themselves as individuals seeking for or giving help in specific communities (Saur-Amaral and Rego, 2010; 2011).

Particular care should be given to overcoming barriers to crowdsourcing. Intellectual property (ownership) issues are critical, as well as, access to specialist crowds (limitations of technology, computer-usage etc.) but most are related to the unpredictable behavior of crowds (crowdslapping, loss of interest in the community etc.).

Most barriers can be overcome by knowing crowd's (specifically key participants') motivations, defining shared ownership strategies, if possible, or establishing appropriate rewards for crowdsourcers.

To conclude, this means that for each type of organization, in order to manage the crowdsourcing process as a component of the distributed innovation management strategy, we may need to:

- Start by defining the role and impact of crowds for this strategy
- Then define, based on the organizational culture, management practices and overall strategy, the communities, which we want to develop or to source
- Comprehend participants' motivational drivers to participate in crowdsourcing initiatives
- Based on those motivation and type of crowd, choose appropriate toolkits to source it
- Define metrics to evaluate crowdsourcing success
- Comprehend ownership issues that may be raised and prepare intellectual property strategy

Start sourcing and monitor along the way and after the crowdsourcing initiative has been concluded, to identify post-crowdsourcing motivations or feedback from participants.

5 Conclusions (and Future Work)

The main outcome of our study is the development of a framework showing how can the wisdom of the crowds be used to enhance organizational innovation, at what level of the organizational innovation (process, project, product/service, overall strategy) and based on what type of knowledge.

This framework is designed to assist innovation professionals and academics to understand how can the wisdom of the crowds be used to enhance organizational innovation, at what level of the organizational innovation (process, project, product/service, overall strategy) and based on what type of knowledge, as well as to suggest academic scholars to use it as a tool to validate in specific populations and further help science to get closer to practice and choose a better way to create an impact onto the economic development.

Any conceptual model should provide tools and research directions to scholars. Exploratory research perspectives should give space to more predictive approaches, using surveys or secondary data to validate existing approaches. This is valid for crowdsourcers' and crowdsourcers' motivations to participate in crowdsourcing initiatives, KPIs related to the measurement and monitoring of the impact crowdsourcing actions. Qualitative methods may be used yet in a multiple case

perspective or in netnographic longitudinal analysis and comparison of several communities.

While the methodology used to develop it, i.e. systematic literature review, is a sound approach and duly applied in this study, there is an inherent limitation applicable to all conceptual models: they have not been validated empirically. Therefore, the applicability and validity of our framework fully depends on future empirical studies where its key dimensions can be confirmed or rejected.

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Appendix: The Review Protocol

Components	Content and rationale
Research goal	We perform the review to identify how crowdsourcing can be used to support organizational innovation, in what situations, with what outcomes and with what differentiated approaches according to the crowd being sourced. We aim to develop a conceptual framework to synthesize key dimensions of crowdsourcing for innovation who can assist innovation professionals and academic scholars to identify approaches and gaps.
Research topic	Refer to section dedicated to wisdom of crowds and crowdsourcing for innovation to see current perspectives over the research topic.
Keywords	Wisdom of crowds; crowdsourcing; collective innovation; collective brain
Research scope	As the research topic has been studied by practitioners and academic scholars, with different perspectives and goals, we decided to combine the search from three databases that cover academic scientific knowledge and practitioner s' opinions and studies on the topic. Our choice fell upon ISI Current Contents (scientific database, impact factor journals), Scopus (broader scientific database), and ABI Inform

Components	Content and rationale
	<p>(peer-reviewed journals and opinion journals). As the three databases may have some articles in common, we will check for duplicates. We will perform the search only in social sciences databases, as we are looking for impact of crowdsourcing on innovation, which is studied in social sciences – business and administration. We will also search in Google Scholar, however in this case we need to do it in full text and we cannot export abstracts. We'll look for full text instead.</p>
Search equation	<p>("wisdom of crowds" OR crowdsourcing OR brain) AND collective AND innovat* We will search in the available field in each database that allows us to look into text contained in abstract, title and keywords, in order to ensure a focused, yet not too restricted search (as it would have been the case of title or keywords search only).</p>
Technical concerns	<p>We will use the database filters to refine the results, when applying criteria like publication year or language, if available. Results for descriptive and thematical analysis and reporting will be exported to Endnote X5, where a preliminary relevance analysis will be performed. After that, relevant results will be exported to xml and from this format they will be imported to NVivo9 for thematic analysis and obtaining descriptive data for statistical treatment.</p>
Inclusion criteria	<p>Relevant results:</p> <ul style="list-style-type: none"> • are articles, books and any other published material or communicated in a written form; • have an abstract or an introduction available to the researcher, in English; • have been published or communicated in writing from 2004 to date.
Quality and validity criteria	<p>We will record all steps during the data collection and apply duly the criteria specified in this review form. As it is not possible, due to operational limitation, to perform the same search by another researcher, the main researcher will perform the search twice, in two consecutive days, and compare results. If differences are identified, reason for that should be identified and kept the correct set of results.</p>
Data extraction	<p>We will extract data from the scientific databases using the export citation function available in each database, preferably applied to all results at once, in a given database. Data will be exported in a dedicated Endnote database, and we will count records at exit in the online database and at entry in Endnote. Same procedure will be considered when relevant records will be exported in xml and then into NVivo.</p>