Crowdsourcing Fundamentals: Definition and Typology

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Chapter 3

Crodwsourcing Fundamentals: Definition and Typology

Enrique Estellés-Arolas[1], Raúl Navarro-Giner and Fernando González-Ladrón-de-Guevara[2]

Abstract Crowdsourcing is a problem solving and task realization model that is being increasingly used. Thanks to the possibility of harnessing the collective intelligence from the Internet, thanks to the crowdsourcing initiatives people can for example find a solution to a complex chemical problem, get images tagged or get a logo designed. Due to its success and usefulness, more and more researchers have focused their interest on this concept. This fact has shown that the concept of crowdsourcing has no clear boundaries, and although over time the concept has been better explained, some authors describe it differently, propose different types of crowdsourcing initiatives or even use contradictory crowdsourcing examples. In this paper, an integrated definition and typology, developed in 2012, are analyzed to check if they are still valid today or whether need a reformulation.

Keywords: crowdsourcing, typology, definition, crowd, task, web, collective intelligence.

3.1. Introduction

The development of Web 2.0 has led to the emergence of new models for business, for communication, for personal relationships, for learning, etc. One of these models, related to business and innovation, is known as crowdsourcing.

The term "crowdsourcing" was first coined in 2006 by American journalist Jeff Howe. In a first attempt to conceptualize the term, Howe (2006) defined it as “the act of a company or institution taking a function once performed by employees and outsourcing it to an undefined (and general large) network of people in the form of an open call. This can take the form of peer-production (when the job is performed collaborative), but is also often undertaken by sole individual”.

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Thanks to the collaborative nature of Web 2.0, crowdsourcing allows a person, institution or company to benefit from the work, ideas or wisdom of the crowd of Internet. This crowd, usually heterogeneous, can be formed by amateurs, volunteers, experts, companies, etc. (Howe, 2008), which may or may not belong to a specific user community (Brabham, 2012). The work of this crowd is rewarded in some way: tangible (money, prizes, etc.) or intangible (recognition, entertainment, prestige, etc.).

This model, which was born in the business environment, has evolved and spread. Currently, crowdsourcing is being used for different purposes in fields as diverse as medicine (King et al., 2013) or geography (See et al., 2014).

The problem is that the wide use of crowdsourcing has made many people to use the term referring to any initiative in which a large number of people are recruited through an open call that is usually distributed through Internet (Howe, 2008; Brabham, 2008; Estellés-Arolas & González-Ladrón-de-Guevara, 2012a; Littman & Suomela, 2014).

For this reason, sometimes the boundaries of what is or is not crowdsourcing are not completely clear. An example is the case of Wikipedia: taking it as a crowdsourcing platform raises both defenders (Bazilian et al, 2012;. Ghani & Zakaria, 2013) and detractors (Brabham, 2013, Estellés-Arolas & González-of-the-Thief Guevara, 2012a). The proliferation of different crowdsourcing definitions and typologies neither help too much.

To alleviate this situation, in 2012 Estellés-Arolas and González-Ladrón-de-Guevara carried out a literature review with the objective of stating an integrative crowdsourcing definition (2012a) and crowdsourcing typology (2012b).

Though both the typology and the definition proposed by Estellés-Arolas and González-Ladrón-de-Guevara are correct and useful, the concept of crowdsourcing continues evolving and being applied in different areas. This situation makes necessary the review of both integrative proposals to test its validity.

For that purpose, this chapter contains the results obtained of repeating the literature review realized in Estellés-Arolas and González-Ladrón-de-Guevara (2012a) in order to find new definitions and new typologies since 2012. The aim is to check whether the definition and typology proposal remain valid or need to be reformulated.

It is true that the crowdsourcing definition and typology mentioned above are not the most used within the literature. The most used are the Howe's (2008) and Brabham's (2008). But certainly counts in its favour that both, definition and typology, seek for consensus integrating different proposals.

3.2. Theoretical Backgroun

3.2.1. Towards an integrated definition

In 2012, Estellés-Arolas and González-Ladrón-de-Guevara, sought through a literature review different crowdsourcing definitions (2012a). The purpose of their research was to extract all the elements which would allow distinguishing between crowdsourcing and any other Internet initiative.

After analyzing more than 200 documents, they found more than 40 different definitions. The authors identified within these definitions eight fundamental elements that any crowdsourcing initiative must contain. These elements are:

1. There is a clearly defined crowd (E1).
2. There exists a task with a clear goal (E2).
3. The recompense received by the crowd is clear (E3).
4. The crowdsourcer is clearly identified (E4).
5. The compensation to be received by the crowdsourcer is clearly defined (E5).
6. It is an online assigned process of participative type (E6).
7. It uses an open call of variable extent (E7).
8. It uses the Internet (E8).

As a result of this research, its authors developed a definition of crowdsourcing, which although being wordy, defines in detail the concept. The definition is as follows: "Crowdsourcing is a type of participative online activity in which an individual, an institution, a non-profit organization, or company proposes to a group of individuals of varying knowledge, heterogeneity, and number, via a flexible open call, the voluntary undertaking of a task. The undertaking of the task, of variable complexity and modularity, and in which the crowd should participate bringing their work, money, knowledge and/or experience, always entails mutual benefit. The user will receive the satisfaction of a given type of need, be it economic, social recognition, self-esteem, or the development of individual skills, while the crowdsourcer will obtain and utilize to their advantage that what the user has brought to the venture, whose form will depend on the type of activity undertaken." (Estellés-Arolas & González-Ladrón-de-Guevara, 2012a)

3.2.2. Towards an integrated typology

Later, Estellés-Arolas & González-Ladrón-de-Guevara (2012b) conducted another literature review searching for different crowdsourcing typologies. They obtained six documents that reported a task-based typology (Reichwald & Piller, 2006; Howe, 2008; Brabham, 2008; Kleeman et al., 2008; Greets, 2008; Burger-Helmchen & Penin, 2010). After comparing all different typologies (Codina, 1997; Pinto-Molina et al., 2007), an integrated typology was stated. It comprises 5 main types:

1. Crowdcasting. Contest-like crowdsourcing initiatives, where a problem or a task is proposed to the crowd, being rewarded who solves it first or do it better (i.e.: Innocentive).
2. Crowdcollaboration. Crowdsourcing initiatives in which communication between individuals of the crowd occurs, while the initiator of the initiative stay on the sidelines. There can be found two subtypes which differ on the ultimate goal:

    - Crowdstorming. Massive online brainstorming sessions, in which different ideas are raised and the crowd can support those ideas with their comments and votes (e.g.: IdeaJam).
    - Crowdsupport. In this case, the customers themselves solve the doubts and problems of other customers so they don't need to contact the official customer support (i.e.: Getsatisfaction).

3. Crowdcontent: In these crowdsourcing tasks, the crowd uses their labor and knowledge to create or find content of various types but not in a competitive way. Three subtypes can be found:

    - Crowdproduction. Initiatives where the crowd should create content, as it is done individually when translating short pieces of text or tagging images (i.e.: Amazon Mechanical Turk).
    - Crowdsearching. Crowdsourcing initiatives where the crowd searches for content on the internet for any purpose (i.e.: Peer to Patent Review).
    - Crowdanalyzing. Initiatives where the crowd searches but not in the Internet but inside multimedia documents like videos or images (i.e.: Stardust@home).

4. Crowdfunding. In the crowdfunding initiatives, an individual, organizacion or company seeks for funding from the crowd in exchange for a reward (i.e.: Kickstarter).
5. Crowdopinion. In this case, the objective is to know the user opinions about a particular issue or product through votes, comments, tags or even sale of shares (i.e.: ModCloth, Intrade).

3.3. Methodology

3.3.1 Regarding the definition

The methodology used to verify whether the integrated crowdsourcing definition is valid is performed in three steps: a systematic review of the literature to find documentation that include crowdsourcing definitions (as shown in Estellés-Arolas & González-Ladrón-de-Guevara (2012a)), the identification of the definition elements following the Tatarkiewicz's approach (1980) and the comparison with the actual integrated definition.

In first place, the systematic review of the literature is done again following the Delgado approach (2010) based on Petitti (2000) and Egger et al. (2008). Five databases has been selected (SAGE, IEEE, ScienceDirect, Emerald and ACM) and documents with the word 'crowdsourcing' in the title, abstract or keywords has been consulted. Only those documents with an original definition for crowdsourcing, and published from 2012, are selected.

Finally, found definitions will be analyzed. It will be checked whether some of the 8 parameters published in the original article using Tatarkiewicz approach (1980) appears, or if instead, any new characteristic should be taken into consideration.

3.3.2 Regarding the typology

Regarding the typology, a similar literature review has been performed. Same databases have been consulted, but search criteria have been modified. In this case, any document containing the term "crowdsourcing" in its title, abstract or keywords has been selected. Also, in the same fields, the terms "typology" or "taxonomy" (either or both) should appear.

Once obtained the documents, those containing a general typology different to the ones found out previously are selected. These typologies will be compared to Estellés-Arolas & González-Ladrón-de-Guevara typology proposal (2012b), updating it if necessary.

3.4. Results

In this section the results obtained by performing the reviews of the literature, both in the search for new definitions as in the search for new typologies, are shown.

3.4.1 Results on the definition

After searching documents in the five databases previously cited, a total of 777 documents were retrieved among journal papers, books reviews, books and proceedings (table 1). It should be noted that the most numerous documents found are proceedings, fact that coincides with the results of the original review of the literature performed by Estellés-Arolas & González-Ladrón-de-Guevara (2012a).

Table 3.1. Summary table of the literature review

	Total	Journal paper	Book review	Book	Proceedings	Use new definition
SAGE	28	24	4	0	0	5
Science Direct	95	86	0	9	0	8
IEEE	248	54	0	0	194	5
ACM	394	1	0	0	393	8
Emerald	12	8	2	2	0	2
TOTAL	777	173	6	11	587	30

Among all the documents found, only 28 (the 3.86%) contains a definition not citing explicitly others like Howe's (2008) or Brabham's (2008). In the table 2 this definitions can be seen.

Table 3.2. New crowdsourcing definitions found through the literature review

n	Document	Page	Definition: Crowdsouring is...
1	(Folorunso & Mustapha, 2014)		"referred to as human computation, a methodology that lets humans process tasks which are difficult to implement in software"
2	(Lee, Park, & Park, n.d.)	60	"the practice of obtaining needed services, ideas, or content by soliciting contributions from a large group of people, particularly from an online community, rather than from traditional employees or suppliers."
3	(Satzger, Psaier, Schall, & Dustdar, 2013)		"a new paradigm for performing computations in Web-based environments by utilizing the capabilities of human workers. The idea of crowdsourcing is sometimes referred to as human computation, a methodology that lets humans process tasks which are difficult to implement in software. Such tasks include transcription of documents, reviewing of articles or evaluating the quality of ranking algorithms."

4	(Sutherlin, 2013)	397	"the technological union of humans and software"
5	(Ambati, Vogel, & Carbonell, 2012)	1,191	"is the process of farming out tasks to a large user population on the Internet. These tasks broadly belong to the language or vision community, where for a number of tasks it is either impossible or challenging and time-consuming for computers to complete them, whereas only requires a few seconds for a human to complete"
6	(Sprugnoli, 2013)	8,116	"the process of segmenting a complex task into smaller work units and distributing these among a large pool of non-expert workers, usually via the web"
7	(Pedersen et al., 2013)	579	"a collaboration model enabled by people-centric web technologies to solve individual, organizational, and societal problems using a dynamically formed crowd of people who respond to an open call for participation"
8	(Roopa, Iyer, & Rangaswamy, 2013)	272	"a technique wherein a task is outsourced to a distributed group of people (crowd).Thus crowdsourcing is a collaborative or distributed problem solving model. Problems are broadcast to unknown group of people asking for solutions. Users (crowd) submit the solutions. The solutions are consolidated by the "crowdsourcer". The crowd may be rewarded monetarily, with prizes, with extra talk time or some other form of recognition. In some cases, the reward could be just intellectual satisfaction"
9	(Wu, Zhong, Tan, Horner, & Yang, 2014)	728	" a process that involves outsourcing tasks to a distributed group of people, which is normally much cheaper than hiring experts"
10	(Zeinalipour-Yazti et al., 2013)	1,240	"a distributed problem solving model where a population of undefined size, en-

			gages in the solution of a complex problem for monetary or ethical (i.e., intellectual satisfaction) benefit through an open call"
11	(Parvanta, Roth, & Keller, 2013)	2	"a problem-solving approach that taps the knowledge, energy and creativity of a global, online community"
12	(Brabham, Ribisl, Kirchner, & Bernhardt, 2014)		"an online, distributed, problem-solving, and production model that uses the collective intelligence of networked communities for specific purposes"
13	(Marjanovic, Fry, & Chataway, 2012)		"under-researched type of open innovation that is often enabled by the web"
14	(Lampe, Zube, Lee, Park, & Johnston, 2014)		"online communities that could help with issues of managing information and users, including the ability to solicit small contributions from a large number of users to help provide important meta-data about people or information"
15	(Britton, Level, & Gardner, 2013)	3	"distributed problem-solving technique leveraging the efforts of a group, known as "the crowd." A project is defined and volunteers are invited to contribute to its accomplishment. The volunteers are dispersed and may not even be members of the organization"
16	(Soleymani & Larson, 2013)	1,111	"human computation techniques that exploit human intelligence and also take advantage of a large population of contributors. Crowdsourcing is fre- quently facilitated by crowdsourcing platforms where crowd- members can find and carry out microtasks in exchange for a small payment"
17	(Perera & A. Perera, 2014)	93	"a process of outsourcing tasks of an organization to general public, where the term 'crowd' equals to 'general public'"
18	(Gupta & Sharma, 2013)	14	"the act of outsourcing tasks, traditionally performed by staff or a contractor, to an

			undefined large group of people or crowd"
19	(Azzam & Jacobson, 2013)	2	"Paid recruitment of an independent global workforce for the objective of working on a specifically defined task or set of tasks"
20	(Demartini, Difallah, & Cudré-Mauroux, 2013)	668	"term used to define those methods to generate or process data asking to a large group of people to complete small tasks. It is possible to categorize different crowdsourcing strategies based on the different types of incentives used to motivate the crowd to perform such tasks"
21	(Schumaker, 2013)		"another form of market efficiency where groups of individuals perform forecasts on provided information and results are averaged for use as a predictive tool"
22	(Raford, 2014)		"Large-scale collective intelligence systems"
23	(Geiger & Schader, 2014)		"an umbrella term for approaches that harness the diverse potential of large groups of people via an open call for contribution over the Web. Using information technology as a facilitator, crowdsourcing organizations implement socio-technical systems to channel the contribution of human workforce, knowledge, skills, or perspectives into the generation of digital information products and services. Such crowdsourcing information systems have recently gained in popularity for a variety of organizational functions such as problem solving, knowledge aggregation, content generation, and large-scale data processing"
24	(Stanley, Winschiers-Theophilus, Onwordi, & Kapuire, 2013)	155	" rooted in the process of asking others to help you with a problem that you cannot resolve on your own. This may be due to limited resources, skills, or time constraints"
25	(King, Gehl,		"Collective effort"

	Grossman, & Jensen, 2013)		
26	(Tong, Cao, & Chen, 2014)	861	"a service has a common framework: each employer (a.k.a the task publisher) poses a task, and then this task is responded or finished by many different and unknown crowd employees. Thus, the "task-response pairs" is the unique structure of crowdsourcing data"
27	(Stol & Fitzgerald, 2014)	187	"an emerging and promising approach which involves delegating a variety of tasks to an unknown workforce— the crowd"
28	(Chiu, Liang, & Turban, 2014)	41	"can be viewed as a method of distributing work to a large number of workers (the crowd) both inside and outside of an organization, for the purpose of improving decision making, completing cumbersome tasks, or co-creation of designs and other projects"

3.4.2 Results on the typology

The typology literature review results have been much less numerous. In fact, after consulting the same databases, 40 documents have hardly been retrieved, of which only one provides an innovative general typology.

Typologies focused on specific areas were found: Linders (2012) states a typology of the crowdsourcing initiatives that can be carried out in e-government; and Gomes et al. (2012) states a crowdsourcing typology focused on musical scene.

The only document that provides a general Typology is the one proposed by Geiger et al. (2012). These authors described an information system-based typology that could sustain the crowdsourcing initiatives. It consists of 4 types:

1. Crowd processing, where the crowd produces a large amount of homogenous contributions with equal value. Some examples are Re-captcha and other micro-tasking tasks like the ones that can be found in AMT, or the tasks done in citizen science projects (i.e.: Galaxy Zoo).
2. Crowd rating, where the crowd also produces a large amount of contributions, with equal value. In this case the value that emerges from the total contribution is sought. This is the case of votes, reviews and opinions

(i.e.: “eBay reputation system”). It would also include prediction markets (i.e.: “Hollywood Stock Exchange”).

3. Crowd solving initiatives seek value from heterogeneous contributions, where each contribution has its own qualitative properties. This crowd solving initiatives look for alternative or complementary solutions to a given task or problem (i.e.: Goldcorp Challenge, Netflix prize or Innocentive).
4. Crowd creation initiatives, finally, seek the collective value arising from the accumulation and relation of contributions. In this case, also each contribution is important towards the creation of a collective result (i.e.: iStockPhoto).

3.5. Discussion

3.5.1 Regarding the definition

Comparing found definitions with the Estellés-Arolas y González-Ladrón-de-Guevara (2012a) integrated definition proposal there can’t be found any relevant difference. All of them meet some of the 8 proposed elements, and those aspects that do not accord with the elements, makes reference to specific applications or particular visions of crowdsourcing.

Definitions around other concepts or models like to open innovation (Marjanovic, Fry, & Chataway, 2012), human computation (Demartini, Difallah, & Cudré-Mauroux, 2013; Satzger, Psaier, Schall, & Dustdar, 2013) or collective inteligence (Raford, 2014) can be found. Other definitions are focused in specific crowdsourcing types such as the crowdproduction using microtasking (Sprugnoli, 2013; Demartini, Difallah, & Cudré-Mauroux, 2013; Lampe, Zube, Lee, Park, & Johnston, 2014) or the use of crowd contest for complex problem solving (Zeinalipour-Yazti et al., 2013; Stanley, Winschiers-Theophilus, Onwordi, & Kapuire, 2013).

It’s important to highlight that there are two definitions, those of Roopa Iyer & Rangaswamy’s (2013) and Geiger & Schader’s (2014), which are highly general, and in fact meet almost all elements of the integrated definition.

About the elements, it is important to notice that almost the totality of the definitions make reference to a crowd (E1) that undertakes a task (E2). Other elements have been taken much less into account: 9 definitions refer to the use of Internet to carry these initiatives out (E8) and 8 of them refer to a process that involves individual online participation (E6).

The remaining elements are less reflected in the found definitions. This indicates that, although those elements allow crowdsourcing identification, they are not considered fundamental by authors.

3.5.2 Regarding typology

In this case, the 4 general types Geiger et al. (2012) proposes could be integrated into the types contemplated by Estellés-Arolas y González-Ladrón-de-

Guevara (2012b). In fact, there is direct correlation between both typologies. Geiger's Crowdrating, Crowdcreation and Crowdsolving corresponds with Estellés-Arolas' Crowdopinion, Crowdproduction and Crowdcontest. In the case of Geiger's Crowdprocessing, this type corresponds with Estellés-Arolas' Crowdsearching and Crowdanalysing.

3.5.2 Regarding the literature review results

Comparing the literature review carried out with the one performed by Estellés-Arolas & González-Ladrón-de-Guevara (2012a), has allowed a limited study of the evolution of crowdsourcing as a research topic.

First of all, it should be highlighted the difference between the number of publications found in 2012 (209) and the number found in 2014 (777). Applying the same criteria and consulting the same databases, 372% more documents were found. It's also significant the increase in the amount of conference paper (127 in 2012 and 587 in 2014; 462% more) also in journal papers (68 in 2012 and 173 in 2014; 254% more).

These data show that crowdsourcing has gone from being an emerging issue, which in 2012 still did not receive much attention, to an actual issue. Besides, this indicates a consolidation in the scientific research on the subject.

Another fact that supports this statement is that, in the first literature review, the 19.13% (40 of 209) of the documents found, used original definitions. In this literature review, this percentage has fallen to the 3.86% (28 of 777). This shows that authors are less interested in defining and conceptualizing crowdsourcing and more interested in researching of concrete applications.

Regarding the definitions found, it is important to highlight some aspects.

1. Firstly, the vast majority of authors use already existing definitions: mainly Howe's (2006) y Brabham's (2008). Estellés-Arolas & González-Ladrón-de-Guevara (2012a) definition, because its integrative nature, is also used although to a lesser extent.
2. Secondly, some documents doesn't have any definition of the term. Some, like Monohan & Mokos (2013) or Su et al. (2013) for example, obviate the crowdsourcing definition when mentioning it. It's assumed that the topic already has its own identity or has become popular enough.
3. Occasionally, the verb "crowdsource" is being used naturally (Garrido & Faria, 2012; Rana et al., 2014; Kalantari et al., 2014). Although the verb does not exist as such in the dictionary, it is a term frequently used to denote the action of using crowdsourcing. This shows that crowdsourcing use is increasingly widespread.

Concerning definitions which are not based in any other, those typically arise from the need to define crowdsourcing from the point of view of an specific task.

Some authors define crowdsourcing relating it to another concepts or models. King et al. (2013) define it as a collective effort, referring to tasks where everyone's contribution is necessary. Others focus on the use of crowdsourcing for co-creation activities (Gatautis & Vitkauskaite, 2014), open innovation (Feller et al,

2012; Ren et al, 2014.), collective intelligence (Garrido & Faria, 2012; Filippi et al, 2013; Raford, 2014) or human computation (Satzger, 2013).

Crowdsourcing is also understood for example as a tool for customers' participation in product development (Djelassi & Decoopman, 2013), public participation (Hildebrand et al., 2013) and e-government (Linders, 2012), citizen science (Harvey et al. , 2014), collecting data (Armstrong et al., 2012), search (Ren et al., 2014) or microtasking (Chen et al., 2014).

It is also important to note that in the literature review carried out by Estellés-Arolas and González-Ladrón-de-Guevara (2012a) there were found different papers referred to the theoretical basis of crowdsourcing. Brabham (2008) analyzes and studies the motivations that move the crowd to participate; Geiger, Seedorf & Schader (2011) propose a taxonomy of crowdsourcing activities; Schenk & Guittard (2009) study what kind of tasks can be performed using crowdsourcing. And so on.

In the literature review carried out in this work, it can be seen that there are practically no such documents. Most items listed study the application of crowdsourcing in some activity or specific area. Schriner & Oerther (2014) study it as way to fight poverty. Brabham et al. (2014) analyze it in the area of public health and medical domain. Related to this field, King et al. (2013) study the use of crowdsourcing in skin self-examination for detecting cancer.

Other applications are establishing the fingerprint of past sea level changes (Rovere et al., 2012), validate data to generate overall landcover maps (See et a., 2014), urban surveillance (Monohan & Mokos, 2013) or animal identification for ecological monitoring and conservation (Duyck et al., 2014).

3.6. Conclusions

Crowdsourcing refers to a problem solving and completing tasks model which involves the participation of the Internet crowd. It represents just one of the many ways to harness collective intelligence. Its use has spread increasingly, being used in many areas: medicine, biology, astronomy, etc. being business area the one in which it was born and in which has been more used.

The popularity of crowdsourcing has made different authors to define and conceptualize crowdsourcing in different ways, even proposing different typologies and definitions. In 2012, Estellés-Arolas y González-Ladrón-de-Guevara suggested, using a literature review, an integrated definition of crowdsourcing based in 8 elements (2012a) and also an integrated crowdsourcing typology (2012b). It is a wordy definition, but it defines the concept in depth. The same applies to the typology.

In the present work the same literature review has been carried out. The objective is to see if the definition and the typology proposed remain valid. Both have been specifically chosen because they share the intention to seek consensus on what is crowdsourcing.

The results of the literature review points that both the definition and the typology remains useful and remain relevant. Firstly, none of the 28 new definitions found identify a new differentiator element. Regarding to the typology, only one

new general typology has been found. This new typology integrates seamlessly into the 2012b typology.

It is true that there is a limitation resulting from the limited number of databases consulted and from using restrictive search criteria. Despite this fact, the literature review, compared to the one conducted by Estellés-Arolas y González-Ladrón-de-Guevara (2012a and 2012b), has partially revealed the development of crowdsourcing in the scientific field.

Crowdsourcing is clearly a researching field that is burgeoning, that now receives increased attention and that has passed from theoretical approaches to the systematic study of its concrete applications in a wide number of fields.

References

Ambati, V., Vogel, S., & Carbonell, J. (2012). Collaborative workflow for crowdsourcing translation. In Proceedings of the ACM 2012 conference on Computer Supported Cooperative Work (pp. 1191–1194). ACM. doi: 10.1145/2145204.2145382

Armstrong, A. W., Harskamp, C. T., Cheeney, S., Wu, J., & Schupp, C. W. (2012). Power of crowdsourcing: Novel methods of data collection in psoriasis and psoriatic arthritis. Journal of the American Academy of Dermatology, 67(6), 1273-1281.e9. doi:10.1016/j.jaad.2012.05.013

Azzam, T., & Jacobson, M. R. (2013). Finding a Comparison Group Is Online Crowdsourcing a Viable Option? American Journal of Evaluation, 34(3), 372–384. doi:10.1177/1098214013490223

Bazilian, M., Rice, A., Rotich, J., Howells, M., DeCarolis, J., Macmillan, S., … Liebreich, M. (2012). Open source software and crowdsourcing for energy analysis. Energy Policy, 49, 149-153. doi:10.1016/j.enpol.2012.06.032

Brabham, D. C. (2008). Crowdsourcing as a model for problem solving an introduction and cases. Convergence: the international journal of research into new media technologies, 14(1), 75-90.

Brabham, D. C. (2012). A Model for Leveraging Online Communities. The participatory cultures handbook, 120.

Brabham, D. C. (2013). Crowdsourcing. Mit Press.

Brabham, D. C., Ribisl, K. M., Kirchner, T. R., & Bernhardt, J. M. (2014). Crowdsourcing Applications for Public Health. American Journal of Preventive Medicine, 46(2), 179–187. doi:10.1016/j.amepre.2013.10.016

Brabham, D. C., Ribisl, K. M., Kirchner, T. R., & Bernhardt, J. M. (2014). Crowdsourcing Applications for Public Health. American Journal of Preventive Medicine, 46(2), 179-187. doi:10.1016/j.amepre.2013.10.016

Britton, C. J., Level, A. V., & Gardner, M. A. (2013). Crowdsourcing: divide the work and share the success. Library Hi Tech News, 30(4), 1–5. doi:10.1108/LHTN-03-2013-0017

Burger-Helmchen, T., & Pénin, J. (2010). The limits of crowdsourcing inventive activities: What do transaction cost theory and the evolutionary theories of the firm teach us. In Workshop on Open Source Innovation, Strasbourg, France (pp. 1-26).

Chen, C., White, L., Kowalewski, T., Aggarwal, R., Lintott, C., Comstock, B., … Lendvay, T. (2014). Crowd-Sourced Assessment of Technical Skills: a novel method to evaluate surgical performance. Journal of Surgical Research, 187(1), 65-71. doi:10.1016/j.jss.2013.09.024

Chiu, C.-M., Liang, T.-P., & Turban, E. (2014). What can crowdsourcing do for decision support? Decision Support Systems, 65, 40–49. doi:10.1016/j.dss.2014.05.010

Codina, L. (1997) Una propuesta de metodología para el diseño de bases de datos documentales (parte II). El profesional de la Información, 6(12),pp. 20-26

Delgado, M. (2010) Revisión sistemática de estudios: Metaanálisis. Signo, Barcelona

Demartini, G., Difallah, D. E., & Cudré-Mauroux, P. (2013). Large-scale linked data integration using probabilistic reasoning and crowdsourcing. The VLDB Journal, 22(5), 665–687. doi:10.1007/s00778-013-0324-z
Demartini, G., Difallah, D. E., & Cudré-Mauroux, P. (2013). Large-scale linked data integration using probabilistic reasoning and crowdsourcing. The VLDB Journal, 22(5), 665–687. doi:10.1007/s00778-013-0324-z
Djelassi, S., & Decoopman, I. (2013). Customers' participation in product development through crowdsourcing: Issues and implications. Industrial Marketing Management, 42(5), 683-692. doi:10.1016/j.indmarman.2013.05.006

Duyck, J., Finn, C., Hutcheon, A., Vera, P., Salas, J., & Ravela, S. (2014). Sloop: A Pattern Retrieval Engine for Individual Animal Identification. Pattern Recognition. doi:10.1016/j.patcog.2014.07.017

Egger, M., Smith, G. D., & Altman, D. (Eds.). (2008). Systematic reviews in health care: meta-analysis in context. John Wiley & Sons.

Estellés-Arolas, E., & González-Ladrón-de-Guevara, F. (2012a). Towards an integrated crowdsourcing definition. Journal of Information science, 38(2), 189-200.

Estellés-Arolas, E., & González-Ladrón-De-Guevara, F. (2012b). Clasificación de iniciativas de crowdsourcing basada en tareas. El profesional de la información, 21(3), 283-291.

Feller, J., Finnegan, P., Hayes, J., & O'Reilly, P. (2012). 'Orchestrating' sustainable crowdsourcing: A characterisation of solver brokerages. The Journal of Strategic Information Systems, 21(3), 216-232. doi:10.1016/j.jsis.2012.03.002

Fienen, M. N., & Lowry, C. S. (2012). Social.Water—A crowdsourcing tool for environmental data acquisition. Computers & Geosciences, 49, 164-169. doi:10.1016/j.cageo.2012.06.015

Filippi, F., Fusco, G., & Nanni, U. (2013). User Empowerment and Advanced Public Transport Solutions. Procedia - Social and Behavioral Sciences, 87, 3-17. doi:10.1016/j.sbspro.2013.10.590

Folorunso, O., & Mustapha, O. A. (2014). A fuzzy expert system to Trust-Based Access Control in crowdsourcing environments. Applied Computing and Informatics. doi:10.1016/j.aci.2014.07.001

Garcia Martinez, M., & Walton, B. (2014). The wisdom of crowds: The potential of online communities as a tool for data analysis. Technovation, 34(4), 203-214. doi:10.1016/j.technovation.2014.01.011

Garrido, P., & Faria, N. (2012). MODSSO–A Manager-centric Global Decision Support System for Organizations. Procedia Technology, 5, 616-624. doi:10.1016/j.protcy.2012.09.068

Gatautis, R., & Vitkauskaite, E. (2014). Crowdsourcing Application in Marketing Activities. Procedia - Social and Behavioral Sciences, 110, 1243-1250. doi:10.1016/j.sbspro.2013.12.971

Geerts, S. (2009). Discovering crowdsourcing: theory, classification and directions for use. unpublished Master of Science in Innovation Management thesis, Eindhoven University of Technology.

Geiger, D., & Schader, M. (2014). Personalized task recommendation in crowdsourcing information systems — Current state of the art. Decision Support Systems, 65, 3–16. doi:10.1016/j.dss.2014.05.007

Geiger, D., Rosemann, M., Fielt, E., & Schader, M. (2012). Crowdsourcing Information Systems-Definition, Typology, and Design. In Proceedings of the International Conference on Information Systems (ICIS 2012) Atlanta, Ga.

Geiger, D., Seedorf, S., Schulze, T., Nickerson, R., & Schader, M. (2011) Managing the Crowd: Towards a Taxonomy of Crowdsourcing Processes. In Proceedings of the Seventeenth Americas Conference on Information Systems

Ghani, A. T. A., & Zakaria, M. S. (2013). Business-IT Models Drive Businesses Towards Better Value Delivery and Profits Making. Procedia Technology, 11, 602-607. doi:10.1016/j.protcy.2013.12.234

Gomes, C., Schneider, D., Moraes, K., & de Souza, J. (2012, October). Crowdsourcing for music: Survey and taxonomy. In Systems, Man, and Cybernetics (SMC), 2012 IEEE International Conference on (pp. 832-839). IEEE.

Gupta, D. K., & Sharma, V. (2013). Exploring crowdsourcing: a viable solution towards achieving rapid and qualitative tasks. Library Hi Tech News, 30(2), 14–20. doi:10.1108/LHTN-01-2013-0002

Hamilton, J. F. (2014). Historical forms of user production. Media, Culture & Society, 36(4), 491–507. doi:10.1177/0163443714523812

Harvey, D., Kitching, T. D., Noah-Vanhoucke, J., Hamner, B., Salimans, T., & Pires, A. M. (2014). Observing Dark Worlds: A crowdsourcing experiment for dark matter mapping. Astronomy and Computing, 5, 35-44. doi:10.1016/j.ascom.2014.04.003

Hildebrand, M., Ahumada, C., & Watson, S. (2013). CrowdOutAIDS: crowdsourcing youth perspectives for action. Reproductive Health Matters, 21(41), 57-68. doi:10.1016/S0968-8080(13)41687-7

Howe, J. (2006). The rise of crowdsourcing. Wired magazine, 14(6), 1-4.

Howe, J. (2008). Crowdsourcing: How the power of the crowd is driving the future of business. Random House.

Kalantari, M., Rajabifard, A., Olfat, H., & Williamson, I. (2014). Geospatial Metadata 2.0 – An approach for Volunteered Geographic Information. Computers, Environment and Urban Systems, 48, 35-48. doi:10.1016/j.compenvurbsys.2014.06.005

King, A. J., Gehl, R. W., Grossman, D., & Jensen, J. D. (2013). Skin self-examinations and visual identification of atypical nevi: Comparing individual and crowdsourcing approaches. Cancer Epidemiology, 37(6), 979–984. doi:10.1016/j.canep.2013.09.004

King, A. J., Gehl, R. W., Grossman, D., & Jensen, J. D. (2013). Skin self-examinations and visual identification of atypical nevi: Comparing individual and crowdsourcing approaches. Cancer Epidemiology, 37(6), 979-984. doi:10.1016/j.canep.2013.09.004

Kleemann, F., Voß, G. G., & Rieder, K. (2008). Un (der) paid innovators: The commercial utilization of consumer work through crowdsourcing. Science, Technology & Innovation Studies, 4(1), PP-5.

Lampe, C., Zube, P., Lee, J., Park, C. H., & Johnston, E. (2014). Crowdsourcing civility: A natural experiment examining the effects of distributed moderation in online forums. Government Information Quarterly, 31(2), 317–326. doi:10.1016/j.giq.2013.11.005

Lee, S., Park, S., & Park, S. (2014). A Quality Enhancement of Crowdsourcing based on Quality Evaluation and User-Level Task Assignment Framework. Big Data and Smart Computing (BIGCOMP), 60 - 65. doi: 10.1109/BIGCOMP.2014.6741408

Linders, D. (2012). From e-government to we-government: Defining a typology for citizen coproduction in the age of social media. Government Information Quarterly, 29(4), 446-454. doi:10.1016/j.giq.2012.06.003

Linders, D. (2012). From e-government to we-government: Defining a typology for citizen coproduction in the age of social media. Government Information Quarterly, 29(4), 446-454.

Littmann, M., & Suomela, T. (2014). Crowdsourcing, the great meteor storm of 1833, and the founding of meteor science. Endeavour, 38(2), 130-138. doi:10.1016/j.endeavour.2014.03.002

Marjanovic, S., Fry, C., & Chataway, J. (2012). Crowdsourcing based business models: In search of evidence for innovation 2.0. Science and Public Policy, 39(3), 318–332. doi:10.1093/scipol/scs009

Monahan, T., & Mokos, J. T. (2013). Crowdsourcing urban surveillance: The development of homeland security markets for environmental sensor networks. Geoforum, 49, 279-288. doi:10.1016/j.geoforum.2013.02.001

Parvanta, C., Roth, Y., & Keller, H. (2013). Crowdsourcing 101 A Few Basics to Make You the Leader of the Pack. Health Promotion Practice, 14(2), 163–167. doi:10.1177/1524839912470654

Pedersen, J., Kocsis, D., Tripathi, A., Tarrell, A., Weerakoon, A., Tahmasbi, N., … de Vreede, G.-J. (2013). Conceptual Foundations of Crowdsourcing: A Review of IS Research (pp. 579–588). IEEE. doi:10.1109/HICSS.2013.143

Perera, I., & A. Perera, P. (2014). Developments and leanings of crowdsourcing industry: implications of China and India. Industrial and Commercial Training, 46(2), 92–99. doi:10.1108/ICT-06-2013-0038

Petitti, D. B. (2000) Meta-analysis, Decision Analysis and Cost-Effectiveness Analysis. (Oxford University Press, New York)

Pinto-Molina, M.; Alonso-Berrocal, J.L. … Doucer, A. (2007) Análisis cualitativo de la visibilidad de la investigación de las universidades españolas a través de sus páginas web. Revista española de documentación científica, 27 (3), pp. 345-370

Raford, N. (2014). Online foresight platforms: Evidence for their impact on scenario planning & strategic foresight. Technological Forecasting and Social Change. doi:10.1016/j.techfore.2014.03.008

Raford, N. (2014). Online foresight platforms: Evidence for their impact on scenario planning & strategic foresight. Technological Forecasting and Social Change. doi:10.1016/j.techfore.2014.03.008

Rana, R., Chou, C. T., Bulusu, N., Kanhere, S., & Hu, W. (2014). Ear-Phone: A context-aware noise mapping using smart phones. Pervasive and Mobile Computing. doi:10.1016/j.pmcj.2014.02.001

Reichwald, R. & Piller, F. (2006) Interaktive wertschöpfung. Open innovation, individualisierung und neue formen der arbeitsteilung. Wiesbaden: Gabler Verlag.

Ren, J., Nickerson, J. V., Mason, W., Sakamoto, Y., & Graber, B. (2014). Increasing the crowd's capacity to create: how alternative generation affects the diversity, relevance and effectiveness of generated ads. Decision Support Systems, 65, 28-39. doi:10.1016/j.dss.2014.05.009

Roopa, T., Iyer, A. N., & Rangaswamy, S. (2013). CroTIS-Crowdsourcing Based Traffic Information System (pp. 271–277). IEEE. doi:10.1109/BigData.Congress.2013.43

Rovere, A., Raymo, M. E., O'Leary, M. J., & Hearty, P. J. (2012). Crowdsourcing in the Quaternary sea level community: insights from the Pliocene. Quaternary Science Reviews, 56, 164-166. doi:10.1016/j.quascirev.2012.09.014

Satzger, B., Psaier, H., Schall, D., & Dustdar, S. (2013). Auction-based crowdsourcing supporting skill management. Information Systems, 38(4), 547–560. doi:10.1016/j.is.2012.09.003

Satzger, B., Psaier, H., Schall, D., & Dustdar, S. (2013). Auction-based crowdsourcing supporting skill management. Information Systems, 38(4), 547-560. doi:10.1016/j.is.2012.09.003

Schriner, A., & Oerther, D. (2014). No Really, (Crowd) Work is the Silver Bullet. Procedia Engineering, 78, 224-228. doi:10.1016/j.proeng.2014.07.060

Schumaker, R. P. (2013). Machine learning the harness track: Crowdsourcing and varying race history. Decision Support Systems, 54(3), 1370–1379. doi:10.1016/j.dss.2012.12.013

See, L., Schepaschenko, D., Lesiv, M., McCallum, I., Fritz, S., Comber, A., … Obersteiner, M. (2014). Building a hybrid land cover map with crowdsourcing and geographically weighted regression. ISPRS Journal of Photogrammetry and Remote Sensing. doi:10.1016/j.isprsjprs.2014.06.016

Schenk, E. & Guittard, C. (2009) Crowdsourcing: what can be crowdsourced to the Crowd and Why? Technical Report.

Soleymani, M., & Larson, M. (2013). Crowdsourcing for multimedia research (pp. 1111–1112). ACM Press. doi:10.1145/2502081.2502234

Sprugnoli, R., Moretti, G., Fuoli, M., Giuliani, D., Bentivogli, L., Pianta, E., ... & Brugnara, F. (2013, May). Comparing two methods for crowdsourcing speech transcription. In Acoustics, Speech and Signal Processing (ICASSP), 2013 IEEE International Conference on (pp. 8116-8120). IEEE. doi:10.1109/ICASSP.2013.6639246

Stanley, C., Winschiers-Theophilus, H., Onwordi, M., & Kapuire, G. K. (2013). Rural communities crowdsource technology development: a Namibian expedition (pp. 155–158). ACM Press. doi:10.1145/2517899.2517930

Stol, K.-J., & Fitzgerald, B. (2014). Two's company, three's a crowd: a case study of crowdsourcing software development (pp. 187–198). ACM Press. doi:10.1145/2568225.2568249

Su, A. I., Good, B. M., & van Wijnen, A. J. (2013). Gene Wiki Reviews: Marrying crowdsourcing with traditional peer review. Gene, 531(2), 125. doi:10.1016/j.gene.2013.08.093

Sutherlin, G. (2013). A voice in the crowd: Broader implications for crowdsourcing translation during crisis. Journal of Information Science, 39(3), 397–409. doi:10.1177/0165551512471593

Tatarkiewicz, W. (1980) A History of Six Ideas-An Essay in Aesthetics. ISBN 90-247-2233-0. Springer

Tong, Y., Cao, C. C., & Chen, L. (2014). TCS: efficient topic discovery over crowd-oriented service data (pp. 861–870). ACM Press. doi:10.1145/2623330.2623647

Wu, B., Zhong, E., Tan, B., Horner, A., & Yang, Q. (2014). Crowdsourced time-sync video tagging using temporal and personalized topic modeling (pp. 721–730). ACM Press. doi:10.1145/2623330.2623625

Xintong, G., Hongzhi, W., Song, Y., & Hong, G. (2014). Brief survey of crowdsourcing for data mining. Expert Systems with Applications, 41(17), 7987–7994. doi:10.1016/j.eswa.2014.06.044

Zeinalipour-Yazti, D., Laoudias, C., Costa, C., Vlachos, M., Andreou, M. I., & Gunopulos, D. (2013). Crowdsourced Trace Similarity with Smartphones. IEEE Transactions on Knowledge and Data Engineering, 25(6), 1240–1253. doi:10.1109/TKDE.2012.55