Factors Influencing the Decision to Crowdsource: A Systematic Literature Review

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Abstract. Crowdsourcing is currently attracting much attention from organisations for its competitive advantages over traditional work structures regarding how to utilise skills and labour and especially to harvest expertise and innovation. Prior research suggests that the decision to crowdsource cannot simply be based on perceived advantages; rather multiple factors should be considered. However, a structured account and integration of the most important decision factors is still lacking. This research fills the gap by providing a systematic literature review of the decision to crowdsource. Our results identify nine factors and sixteen sub-factors influencing this decision. These factors are structured into a decision framework concerning task, people, management, and environmental factors. Based on this framework, we give several recommendations for managers making the crowdsourcing decision.

Keywords: Crowdsourcing, Crowdsourcing decision, Organisational decision making, Systematic literature review

1. Introduction

Crowdsourcing utilises a mass of online contributors to perform tasks that are traditionally performed by internal employees and/or outsourced to external entities (Howe, 2006). It is an emerging organisational practice that has attracted much attention over the last decade. Examples of organisations successfully adopting this approach include Starbucks for collecting customers' ideas (Lee & Seo, 2013), Threadless for T-shirt design (Brabham, 2010), SAP for leveraging innovative ideas (Leimeister, Huber, Bretschneider, & Krcmar, 2009), and Amazon Mechanical Turk for micro tasks (Ipeirotis, Provost, & Wang, 2010). The success of these initiatives suggests that crowdsourcing can handle a wide range of goals, from information processing to problem solving, and from ideas gathering to solution elaboration (Kittur et al., 2013; Zhao & Zhu, 2014). Prior research recommends that

organisations can gain competitive advantages by choosing the crowd to perform certain tasks (Brabham, 2013; Gassenheimer, Siguaw, & Hunter, 2013). More precisely, flexible and virtually limitless workforce, large and varied skills, and relatively low cost are some competitive advantages of crowdsourcing suggested by the literature (Saxton, Oh, & Kishore, 2013; Zhao & Zhu, 2014).

Despite these advantages, more recent research highlights that the decision to crowdsource cannot simply be based on perceived advantages. Rather, it is a complex decision making process, where multiple contingency elements should be considered (Djelassi & Decoopman, 2013; Zhao & Zhu, 2014). By and large, we identify two important aspects of this decision making process. One concerns the managerial view, which is responsible for deciding to crowdsource, and thus has to equate its costs and benefits, e.g. coordination costs and required quality. The other important aspect to consider is how to design a particular crowdsourcing activity, deciding what technology to be used and defining components and functions of the corresponding crowdsourcing system. While design issues have been investigated by many researchers (Alonso & Baeza-Yates, 2011; Hetmank, 2013; Kittur et al., 2013; Zheng, Li, & Hou, 2011), there has been little focus on the managers' perspective.

In this research we address the managers' view to investigate the decision to crowdsource, following the call from Zhao and Zhu (2014). Several studies agree that the decision to crowdsource is the stepping stone of a crowdsourcing process (Lüttgens, Pollok, Antons, & Piller, 2014; Muhdi, Daiber, Friesike, & Boutellier, 2011), and also suggest that it is most important because it directly links to organisational strategies, i.e. open or closed to the crowd (Seltzer & Mahmoudi, 2013), and largely affects the usage of organisational resources (Rouse, 2010). Further, with its starting position, the decision to crowdsource is definitive, which means it cannot be changed in the latter stages of a crowdsourcing process, and thus determines the success of the entire crowdsourcing project (Muhdi et al., 2011).

With this crucial role in mind, researchers have already begun to investigate the decision to crowdsource (Afuah & Tucci, 2012; Lu, Hirschheim, & Schwarz, 2015; Ranade & Varshney, 2012). As a result, many factors influencing the decision to crowdsource have been identified. Some studies, maybe for simplification, examine one single factor to suggest when organisations should crowdsource. For instance, Ranade and Varshney (2012) addressed the question "to crowdsource or not to crowdsource" (p. 1) by mainly focusing on the nature of tasks. Naroditskiy et al. (2013) considered "the trade-off between the potential for increased productivity with the possibility of being set back by malicious behaviour" (p. 1). However, more recent studies recommend examining potential benefits and risks of crowdsourcing (Lu et al., 2015; Muhdi et al., 2011) and weighting organisational contexts against general crowdsourcing capabilities (Djelassi & Decoopman, 2013). Consequently, multiple factors should be considered when making a crowdsourcing decision (Afuah & Tucci, 2012; Lu et al., 2015; Zhao & Zhu, 2014). Following this approach, different factors that influence the decision to crowdsource have been proposed by several studies (e.g. Afuah & Tucci, 2012; Lu et al., 2015; Zogaj, Bretschneider, & Leimeister, 2014). Yet, different studies suggest different lists of factors, leading to the current lack of a common account of factors influencing the decision to crowdsource. Moreover, the relationships, similarity, and disparity among these factors have not yet been examined. As a result, the following research question still needs to be investigated.

Research Question: What factors influence an organisation's decision to crowdsource?

To address this question, we conducted a systematic review of existing literature on the decision to crowdsource. The systematic review, which refers to an explicit, organised process of analysing and synthesising a body of literature (Okoli & Schabram, 2010), helps

systematically identifying the factors influencing the decision to crowdsource and synthesising the different lists of factors existing in the literature. As these factors may link to each other, we decided to structure them into a layered decision framework emphasising crowdsourcing as a socio-technical system (Geiger, Rosemann, Fielt, & Schader, 2012; Zhao & Zhu, 2014). Based on the obtained results, we suggest how managers can thoroughly ponder the different factors affecting the decision to crowdsource.

Although a few literature reviews were conducted in the field of crowdsourcing, benefiting the emerging area "from exposure to potential theoretical foundations" (Webster & Watson, 2002, p. 2), none of them focus on the decision to crowdsource. Some of them aim to review the literature for establishing the background of the crowdsourcing field. For instance, Zhao and Zhu (2014) and Pedersen et al. (2013) conceptualised the field by evaluating the existing research on crowdsourcing, while Estellés-Arolas and González-Ladrón-de-Guevara (2012) synthesised the definition of crowdsourcing. Others review the literature to develop a conceptual framework addressing a specific research question. Hetmank (2013) surveyed 220 research papers in order to design components and functions of a crowdsourcing system. Also focusing on a particular issue, Boughzala et al. (2014), based on a literature review (Pedersen et al., 2013), developed a model on how to organise crowdsourcing ideation processes. In short, the existing literature reviews have contributed to the crowdsourcing field by conceptualising the emerging area and building conceptual frameworks for particular research problems. However, there have been no reviews of the literature on the decision to crowdsource.

The current study is expected to be relevant for both academics and practitioners. We conduct, for the first time, a review and analysis on the 'decision to crowdsource' body of literature. As a result, we identify the most significant factors that need to be considered when making the decision to crowdsource, addressing the question raised in the literature "to crowdsource or not to crowdsource" (Ranade & Varshney, 2012, p. 1). Another contribution of this study is incorporating these factors in a generalised decision framework that avoids particular foci, goals, and contexts. From a more practical point of view, our research supports managers with providing applicable recommendations about when to adopt a crowdsourcing strategy in a particular organisational context. Decision tables were adopted to structure these recommendations.

The remainder of our paper is structured as follows. Section 2 presents the conceptual background of this research. Section 3 describes the systematic literature review method adopted by this study. Findings from the systematic literature review are presented and analysed in Section 4. As a result, a list of factors influencing the decision to crowdsource and the corresponding decision framework are elaborated. Section 5 discusses our findings and provides recommendations for decision makers. Finally, Section 6 provides some concluding remarks and discusses future work.

2. Background

2.1. Concepts and Taxonomies of Crowdsourcing

Since Howe (2006) popularised the concept of 'crowdsourcing', different terminologies were used to describe the phenomenon, such as collaborative systems, collective intelligence, crowd wisdom, and mass collaboration (Doan, Ramakrishnan, & Halevy, 2011). Other terms can also be found in the literature, including open innovation (Marjanovic, Fry, & Chataway, 2012), collective wisdom (Hwang, Yuan, & Weng, 2011) and crowd work (Kittur et al., 2013). In this study, the term 'crowdsourcing' is used because this term thoroughly captures

the concept and was widely used by many studies in the field (Estellés-Arolas & González-Ladrón-de-Guevara, 2012; Howe, 2006; Thuan, Antunes, & Johnstone, 2015). Given that crowdsourcing is an emerging research field, the concept of crowdsourcing has been conceptualised by different researchers, and most of them either discuss the definition of crowdsourcing or propose taxonomies to structure the field.

To define the concept of crowdsourcing, some researchers compared this concept with the outsourcing concept (Howe, 2006; Saxton et al., 2013), while others defined crowdsourcing as an approach for problem solving (Afuah & Tucci, 2012; Doan et al., 2011). In some cases, crowdsourcing was defined according to its applied contexts, such as small and medium enterprises (Maiolini & Naggi, 2011) and Business-to-Business applications (Kärkkäinen, Jussila, & Multasuo, 2012). The definition of crowdsourcing became ambiguous when a single researcher, such as Brabham (2008, 2010, 2013) or Vukovic (2009; 2010), provided more than one definition. Addressing this ambiguity, Estellés-Arolas and González-Ladrón-de-Guevara (2012) recently analysed and synthesised 40 definitions extracted from 209 crowdsourcing papers. As a result, they proposed a definition covering "any given crowdsourcing activity" (p. 190), which was characterised by the following elements: a defined crowd, a delineated task, a clear recompense for the crowd, the identified crowdsourcer, defined benefits for the crowdsourcer, an online process, the open call, and internet usage.

We agree with the definition proposed by Estellés-Arolas and González-Ladrón-de-Guevara (2012), but note that it is too complex (Brabham, 2013). In this study, we adapt and simplify it as the following definition of crowdsourcing. *Crowdsourcing is defined as an online strategy, in which an organisation proposes defined task(s) to the members of the crowd via a flexible open call in order to harness their work, knowledge, skills and/or experience.*

In addition to definitions, researchers also conceptualised the crowdsourcing field by proposing taxonomies to structure the field (Brabham, 2012a; Rouse, 2010; Whitla, 2009) because taxonomies, according to Nickerson et al. (2012), help organising knowledge in the Information Systems (IS) discipline. It is worth noting that although several other terms, like framework and typology, were used to discuss crowdsourcing classification schemes, the term 'taxonomy' was chosen because it is the most common term used to discuss a classification scheme in IS discipline (Nickerson et al., 2012). In a closer look on the existing crowdsourcing taxonomies, some of them adopted one dimension to classify crowdsourcing activities. For instance, Whitla (2009) identified three types of crowdsourcing activities based on their purpose: product development, advertising and promotion, and marketing research. In the same vein, Brabham (2012a) classified crowdsourcing activities on their functions as knowledge discovery and management, broadcast search, peer-vetted creative production, and distributed human intelligence tasking.

Alternatively, many studies took a multi-dimensional approach to classify crowdsourcing. Rouse (2010) presented one of the earliest taxonomies of crowdsourcing with three dimensions: nature of the task, distribution of benefits, and forms of motivation. Analysing 250 instances of crowdsourcing, Malone et al. (2010) based their classification around four basic questions: what is being crowdsourced, who is performing the task, why people do this, and how the task is being done. Other multi-dimensional taxonomies of crowdsourcing can also be found in the work by Schenk and Guittard (2011), Geiger et al. (2011) and Saxton et al. (2013).

According to Nickerson et al. (2012), 'usefulness' is one crucial criterion to evaluate a taxonomy and its dimensions, as seen via "the [resulting] taxonomy needs to be evaluated for its usefulness" (p. 11). Thus, choosing dimensions for crowdsourcing classification in the

current study should be based on their usefulness in addressing the research question. In the decision to crowdsource, two useful dimensions are task complexity and how task can be achieved. Both Zhao and Zhu (2014) and Ranade and Varshney (2012) suggest examining the complexity of tasks before making this decision. Besides, we believe that whether tasks are achieved individually or competitively can also influence this decision, because it directly affects how the crowd approaches the tasks (Hetmank, 2013).

Given that these two dimensions are important in the decision to crowdsource, we adapted a taxonomy proposed by Schenk and Guittard (2011), who suggested two similar dimensions to classify crowdsourcing activities. In the first dimension, these authors classified tasks as simple, complex, or creative. Simple tasks can be accomplished with general skills; complex tasks require knowledge and expertise to solve a problem; and creative tasks depend on individual creativity. It is worth noting that most complex tasks require certain levels of creativity, while creative tasks' purposes are normally to find solutions for particular problems. Consequently, the two categories are not much different and were combined to be collectively called 'skilled' tasks. This is consistent to Brabham (2012c), who view a creative activity, like architectural design, as a problem solving task. In the second dimension, the current study aligned with Schenk and Guittard (2011) to distinguish between the integrative and selective nature of tasks. This distinction refers to the participation mode representing how tasks can be performed individually or competitively. Table 1 presents examples of different types of crowdsourcing, based on task complexity and participation mode.

Table 1. Examples of crowdsourcing task types

Participation mode Complexity	Individual (Integrative)	Competitive (Selective)
Simple	**Market place** - Amazon Mechanical Turk - Taskcn	**Simple contest** - Yahoo Answers - Askville by Amazon
Skilled	**Collective intelligence** - Wikipedia - Software testing (Tung & Tseng, 2013)	**Problem solving contest** - InnoCentive - Bus stop shelter design (Brabham, 2012c)

2.2. Decision to Crowdsource

The literature suggests that a crowdsourcing activity begins with the decision to crowdsource, which considers whether crowdsourcing is an appropriate approach to enhance the achievement of organisational tasks. Indeed, Wexler (2011) positioned this decision in the first phase of the crowdsourcing activity, where organisations should have the following three actions: (1) recognising benefits and challenges of crowdsourcing, (2) evaluating the efficiency and effectiveness of crowdsourcing compared to other types of sourcing, i.e. internal sourcing or outsourcing, and (3) preparing resources to start approaching the crowd. Similarly, Muhdi et al. (2011) described the crowdsourcing activity as a five-stage process, and in the first stage, organisations "have to decide whether the crowdsourcing approach is appropriate to solve their internal problem/problems [tasks]" (p. 322). In this decision, Muhdi et al. (2011) were nearly consistent with Wexler (2011) in proposing the aforementioned actions, and further suggested that organisations should convince their employees to support the crowdsourcing approach when making the decision to crowdsource or not. A similar purpose and position of the crowdsourcing decision in the crowdsourcing process was

explicitly stated by other researchers (Burger-Helmchen & Pénin, 2010; Djelassi & Decoopman, 2013; Lüttgens et al., 2014; Thuan, Antunes, & Johnstone, 2014).

Given these discussions, the current study defines *the decision to crowdsource as a process that evaluates whether crowdsourcing is an appropriate approach to perform particular organisational tasks. In the decision to crowdsource that starts a crowdsourcing activity, organisations need to consider multiple aspects, including organisational contexts, and crowdsourcing benefits, challenges, and capabilities in order to evaluate their readiness to crowdsource.*

There are several reasons why the decision to crowdsource is significant for organisations that aim to utilise the crowd. First, this decision links directly to organisational strategies, and one of which is whether to open or close their business processes to the crowd (Seltzer & Mahmoudi, 2013). Second, inappropriate crowdsourcing decisions will likely affect organisations due to unplanned challenges and the waste of the organisational resources (Rouse, 2010). Third, whereas crowdsourcing can help organisations to build relationships with the crowd, including their customers (Djelassi & Decoopman, 2013), a failed crowdsourcing project caused by the decision to crowdsource may have a negative impact on the organisation's reputation. Finally, starting the crowdsourcing activity, the decision to crowdsource cannot be changed in the latter stages of the crowdsourcing process, and thus it influences the success of the entire crowdsourcing activity (Muhdi et al., 2011).

Consequently, there has been increasing interest in the decision to crowdsource, especially the factors driving this decision. Studies focused on the factors driving decision-making can be generally classified into two directions. In the first direction, few studies focused on one criterion to evaluate the appropriateness of crowdsourcing in a particular situation or task. Mainly focusing on the nature of task, i.e. single and multiple tasks, Ranade and Varshney (2012) examined circumstances to crowdsource or not to crowdsource a problem-solving contest. Also focusing on a single factor, Naroditskiy et al. (2013) investigated malicious behaviour on crowdsourcing activities and suggested that making the decision to crowdsource for problem solving tasks should consider the trade-off between the benefits and the possibility of receiving malicious results.

In the other direction, many researchers recently proposed that the decision to crowdsource is a complex process requiring several criteria to be evaluated (Djelassi & Decoopman, 2013; Thuan, Antunes, & Johnstone, 2013; Zhao & Zhu, 2014). Examining crowdsourcing for problem solving contests similar to Ranade and Varshney (2012) and Naroditskiy et al. (2013), Afuah and Tucci (2012) suggest five factors that need to be considered before the decision to crowdsource can be made. Four of them are organisational and environmental factors that positively influence the probability of crowdsourcing. They are characteristics of the problem, characteristics of the knowledge required for the solution, characteristics of the crowd, and characteristics of both the solutions to be evaluated and the evaluators. The fifth factor is the Information Technology (IT) characteristics, which positively moderate the relationship between the organisational factors and the probability of crowdsourcing.

Choosing a different type of crowdsourcing, i.e. collective intelligence in scientific method, Buecheler et al. (2010) still suggest multi-criteria for analysing the viability of crowdsourcing. Using the 'three constituents principle' adopted from Artificial Intelligence, these authors propose a framework of three factors (environment, agent, and task) to determine the context where crowdsourcing should be viable. However, these authors note that the framework was not fully validated: "the data collection was not thorough enough to analyse all the variables mentioned in our framework" (Buecheler et al., 2010, p. 682).

Investigating "five antecedent factors involved in making online microsourcing decisions" (p. 1), Lu et al. (2015) collected data from 240 clients on an IT crowdsourcing platform to test the influence of these factors on the crowdsourcing decision. Analysing the collected data, these authors confirm three factors that lead organisations to choose crowdsourcing, including the capability to access resources and expertise, the ability to obtain complementary resources, and the availability of platforms for filling resource gaps. Moreover, these authors also find that the remaining factors, i.e. cost reduction and risk, may not be important in determining the decision to crowdsource.

Based on the aforementioned studies, making an informed decision whether to crowdsource or not requires a comprehensive analysis, in which multiple factors should be examined in a systematic way (Rouse, 2010; Thuan et al., 2013; Zhao & Zhu, 2014). However, the existing literature examining these factors is not comprehensive in two aspects. First, there is lack of a commonly accepted list of factors that affect the decision to crowdsource. Second, these individual studies have focused on a particular type of task, such as problem solving contests (Afuah & Tucci, 2012), collective intelligence (Buecheler et al., 2010), or microsourcing (Lu et al., 2015). Therefore, the overall picture on the crowdsourcing decision is still unveiled. Moreover, there is fundamental need for a comprehensive framework supporting managers making the crowdsourcing decision. Taking that into consideration, this study aims to address this gap by analysing the accumulated knowledge in the literature to synthesise the factors influencing the crowdsourcing decision.

3. Method

The current study adopts a systematic literature review as its research method for identifying and analysing the factors, playing a significant role in the decision to crowdsource. As different decision factors have been suggested in the crowdsourcing literature, the use of literature review helps extracting these factors and more importantly synthesising the different lists of factors existing in the literature. A similar approach was successfully used to identify the determinants of outsourcing decision (Dibbern, Goles, Hirschheim, & Jayatilaka, 2004). Regarding the way to conduct the review, although a narrative review could still be utilised, the method adopts a 'systematic' approach that refers to a structured and well-defined protocol of the review (Kitchenham et al., 2009; Okoli & Schabram, 2010), which increases rigour and transparency of the method. More precisely, we based our method on the recommendations provided by Okoli and Schabram (2010), Kitchenham (2007), and Levy and Ellis (2006), and adopted the six stages described below, including selecting articles, filtering articles, classifying articles, forward and backward search, data extraction, and data synthesis. Fig. 1 summarises the stages of the systematic literature review.
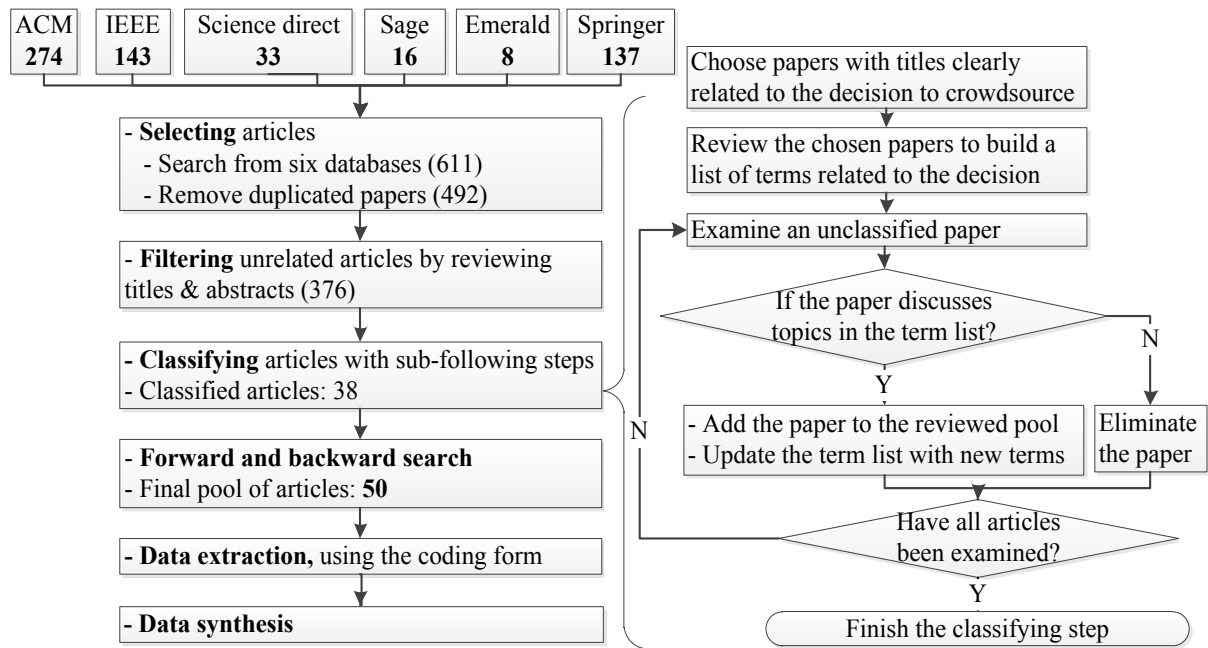
Fig. 1 Detailed stages of the systematic literature review regarding the decision to crowdsource

3.1. Selecting Articles

At this initial stage we searched for and selected relevant articles addressing the crowdsourcing subject. Following a concept-centric approach (Webster & Watson, 2002), the review was not limited but open to several knowledge sources. It included both journal and conference articles, since the important role of conference publications in IS-related fields, such as computer science, is well documented (Freyne, Coyle, Smyth, & Cunningham, 2010). The search was conducted between February and March 2013 on six major academic databases, including ACM, IEEE, Science Direct, Sage, Emerald, and Springer. We chose 'crowdsourcing' as the searching keyword as it has been presented as a well-presentative keyword, which has also been used by other reviews in the field (Estellés-Arolas & González-Ladrón-de-Guevara, 2012). We checked that searches using similar keywords like 'crowdsource', 'crowdsourced', and 'crowd', identify the same corpus and therefore can be discarded. From the searching results, only articles that have been written in English and were available in full-text were selected. Consequently, 611 articles were found, as summarised in Table 2.

Table 2. Search results

Databases \ Types	ACM	IEEE	Science Direct	Sage	Emerald	Springer	**Total**
Conference	274	110					**384**
Journal		33	33	16	8	137[1]	**227**
Total	274	143	33	16	8	137	**611**

After removing duplicates, editorial introductions, posters, tutorials, workshop summaries, 'in brief' papers, and publications that accidentally use the searching keyword but do not have a clear focus on crowdsourcing, a total of 492 articles remained in the initial pool.

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[1] Including book chapters and lecture notes

3.2. Filtering Articles

Although the initial pool has hundreds of articles addressing various aspects of crowdsourcing, only a part of them are relevant to the current study. This stage applied a screening technique introduced by Okoli and Schabram (2010) to filter out articles that are clearly irrelevant to the decision to crowdsource. More specifically, we eliminated articles having a design focus, dealing with crowdfunding, and discussing legal issues. As previously mentioned, we make a clear distinction between the managerial and design views, and have focussed this research on the managerial view. The elimination was based on the articles' titles and keywords. We used a list of design topics elaborated by Kittur et al. (2013) to eliminate papers from the pool. This list includes topics like crowdsourcing process design, task assignment, designing real-time crowdsourcing tasks, collaboration support, and quality control, which are logically addressed after the decision to crowdsource. The result of this pass was that 116 articles were filtered out for being related to design (112), crowd funding (3), and legal issues (1), and consequently the pool was reduced to 376 articles.

3.3. Classifying Articles

While the previous stage was intended to eliminate papers unrelated to our study, this stage aimed to include papers focusing on the decision to crowdsource *per se*. Since there is currently no classification frame or keyword schema to discriminate papers specifically related to the crowdsourcing decision from the unrelated ones, we developed the following procedure. The procedure has four iterative steps, as seen via the right-hand side of Fig. 1. Aligning with Okoli and Schabram (2010), a tolerant view was applied to this classification, which means that to include rather than exclude was decided for articles perceived to broadly refer to the crowdsourcing decision (e.g. Feller, Finnegan, Hayes, & O'Reilly, 2012; Kittur et al., 2013; Rouse, 2010).

First, we scanned the 376 papers to choose the ones whose titles were clearly related to the decision to crowdsource. Examples include titles like 'To crowdsource or not to crowdsource?' (Ranade & Varshney, 2012) and 'Examining the antecedent factors of online microsourcing' (Lu et al., 2015). Second, the chosen papers were reviewed in order to identify important keywords, terms, and phrases related to the crowdsourcing decision. A list of relevant terms was also elaborated during this step.

Third, the remaining papers were further examined to check if they were related with the list of terms identified in the previous step. This examination involved an analysis of each paper's abstract, introduction, and conclusion. If a paper has term(s) in the list (or phrases having equivalent meaning with terms in the list), it is added to the reviewed pool. Fourth, by reviewing the added paper, the term list may have been updated with new terms. Step three and four were repeatedly performed for all remaining articles. As a result of this procedure, the terms list ended up including the following terms: crowdsource or not to crowdsource, crowdsourcing circumstances, antecedent factors, success factors, crowdsourcing decision, feasibility of using crowdsourcing, crowdsourcing ability, crowdsourcing viability, crowdsourcing alternatives, probability of crowdsourcing, crowdsourcing framework, benefits of crowdsourcing, and risks of crowdsourcing.

By applying this procedure, we classified 38 articles related to the decision to crowdsource. The relatively small number of articles that were left is consistent with a recent literature survey by Zhao and Zhu (2014), which also reports a limited number of studies on crowdsourcing adoption due to the emerging status of the field.

3.4. Forward and Backward Search

Following Levy and Ellis's (2006) suggestions, we conducted forward and backward searches based on the 38 papers that remained in the pool. For each paper, we examined its references on a backward search, and used Google Scholar to identify articles that cited the paper on a forward search. The identified articles were classified based on the terms list, which was built in the previous step. This procedure uncovered 10 additional articles relevant to the focus of this study. We note however that, as crowdsourcing is an emerging field (Zhao & Zhu, 2014), articles related to the decision to crowdsource may have been published after March 2013, when our search procedure was concluded. To keep the study up-to-date, we conducted a further forward search on February 2014 and added two new papers to the pool, increasing the final list of papers to 50.

3.5. Data Extraction

This stage extracted data from the reviewed papers to identify factors that have impact on the decision to crowdsource. To this end, a coding form was developed. Following Kitchenham et al.'s (2007) suggestion to test the form, 10% of the articles were coded independently and the coding results were compared among the researchers, leading to some small changes applied to the coding form. This form (see Appendix B) codifies the following four dimensions of the problem: general information about the paper, research topics, research findings, and practical outcomes. Besides some general information (article reference, year of publication, date of coding, and additional notes) typically extracted in systematic literature reviews (Okoli & Schabram, 2010), the following dimensions were extracted.

One important coding dimension concerns the article's main topics. As the reviewed articles were previously classified according to the decision to crowdsource, we believe that further analysing the topics addressed by these articles provides a more complete picture on the decision to crowdsource. An initial analysis of the reviewed articles, which was developed during the classifying stage, revealed five main topics. They are: 1) circumstance to crowdsource and influencing factors; 2) position of the decision to crowdsource within the crowdsourcing process; 3) benefits and opportunities; 4) risks and challenges; and 5) capabilities and characteristics of crowdsourcing. Besides considering these categories, in the coding form we also allowed for emerging categories as an inductive approach (Thomas, 2006). It is worth reminding that because of the tolerant view that was adopted in the aforementioned classification stage, multiple topics could be coded for each reviewed article.

The coding form also gathered data about research findings and how knowledge may be generated from these findings. For each article, the main findings were recorded regarding the codified topics. In addition, the coding form also gathered how knowledge can be generated from the findings. Following Mingers (2003), this considers whether findings can be generalised to other situations or only to a similar context.

The final considered dimension codifies the article's practical outcomes, focussing on useful recommendations about the decision to crowdsource. These practical outcomes may be extracted directly from the implications/recommendations section often presented in research papers or indirectly from the papers' discussion section. Another coded element was the crowdsourcing context. This is relevant because contextual descriptions often play an important role when applying IS findings to reality (Benbasat & Zmud, 1999). In crowdsourcing studies, contexts have been described through a few different elements, two of which have been repeatedly found in the research literature and thus were considered in our coding form: application (Zhao & Zhu, 2014) and task nature (see Table 1).

The form incorporating these dimensions was applied to codify all 50 articles. Following Kitchenham et al. (2007), coding was undertaken by the first author, while the other authors randomly checked 20% of the codified papers. In case of disagreement on data extraction, the three researchers discussed until reaching consensus. When coding each article, factors that potentially influence the decision to crowdsource were allocated as quotes, similar to the technique used by Smith et al. (2008). These quotes were then compared and synthesised in the next stage. It is important to note that data extraction was conducted from a managerial perspective, thus data related with other perspectives, such as the motivation of the crowd to participate in crowdsourcing (Zheng et al., 2011), were not recorded. Details of the coding can be found in this web page.

3.6. Data Synthesis

This stage synthesised the data extracted through the coding form in order to answer the research question. More precisely, we reviewed the data extracted by the coding form to build a list of factors influencing the decision to crowdsource. We merged duplicate factors, such as 'the crowd' (Afuah & Tucci, 2012) and 'workers' (Wang, Hoang, & Kan, 2013). In addition, many factors were related to each other, such as tasks (Saxton et al., 2013) and the modularizability of tasks (Afuah & Tucci, 2012). To rationalise the relationship between these factors, we classified them as 'generic' factors and sub-factors, giving a final list of 9 factors and 16 sub-factors (Section 4.1).

It is worth noting that other data collected by the coding form were synthesised and used to support the results and discussion of the current study. In particular, the practical outcomes of the reviewed articles were synthesised in the decision tables discussed in Section 5.

4. Results

In this section we report results from the systematic literature review, starting by an overview of the pool of reviewed articles. As previously mentioned, 50 articles related to the decision to crowdsource were identified. Out of these, 26 appear in journals while the rest are conference papers and one working paper (Sharma, 2010). These papers were published in a wide range of outlets concerning information systems (Feller et al., 2012; Lu et al., 2015), management (Afuah & Tucci, 2012) and business (Zogaj et al., 2014). The full list of articles is listed in Appendix A.

A closer look at the pool of articles reveals a relatively even distribution of topics, including: capabilities and characteristics of crowdsourcing (20 articles); risks and challenges (18 articles); circumstances to crowdsource and influencing factors (18 articles); benefits and opportunities (10 articles); and the position of the decision to crowdsource within the crowdsourcing process (3 articles). While the 18 articles focusing on the circumstances to crowdsource directly link to the research question, the remaining articles also reveal the diversity of factors influencing the decision to crowdsource. Our results, consistent with Muhdi et al. (2011) and Lu at al. (2015), indicate that the crowdsourcing decision is a complex decision influenced by an assessment of various benefits, risks, and characteristics of crowdsourcing. Indeed, we find that 92% reviewed articles reveal at least one factor that should be evaluated when making the crowdsourcing decision. Only four articles do not suggest any influencing factors. These articles position the decision to crowdsource in a crowdsourcing process in general (Wexler, 2011), consider the possibility of using crowdsourcing in Business-to-Business contexts (Kärkkäinen et al., 2012), discuss

crowdsourcing as a means for collaboration (Yue & Blevis, 2011), and suggest 'hybrid organisational forms' (Trompette, Chanal, & Pelissier, 2008).

Regarding the years of publication, Fig. 2 shows the number of articles published per year between 2008 to the beginning of 2014. Based on this figure, we agree with Zhao and Zhu (2014) that the number of studies on crowdsourcing adoption is still limited, with less than 10 studies per year. On the other hand, we note a development of research on the decision to crowdsource on two aspects. First, the number of studies is increasing, which is consistent with the development of the crowdsourcing field (Zhao & Zhu, 2014). Second, our results indicate that the number of studies having findings that can be generalised to other situations is also increasing (the top part of the columns in Fig. 2). Between 2008 and 2011, most studies on the decision to crowdsource seem to be exploratory, leading to the dominance of findings that can only be transferred to a similar context. More recently, research seems to focus more on testing and validating broad aspects of the decision to crowdsource, resulting in more findings that can be applied to different contexts. This, at some level, explains the increasing maturity of the crowdsourcing area.
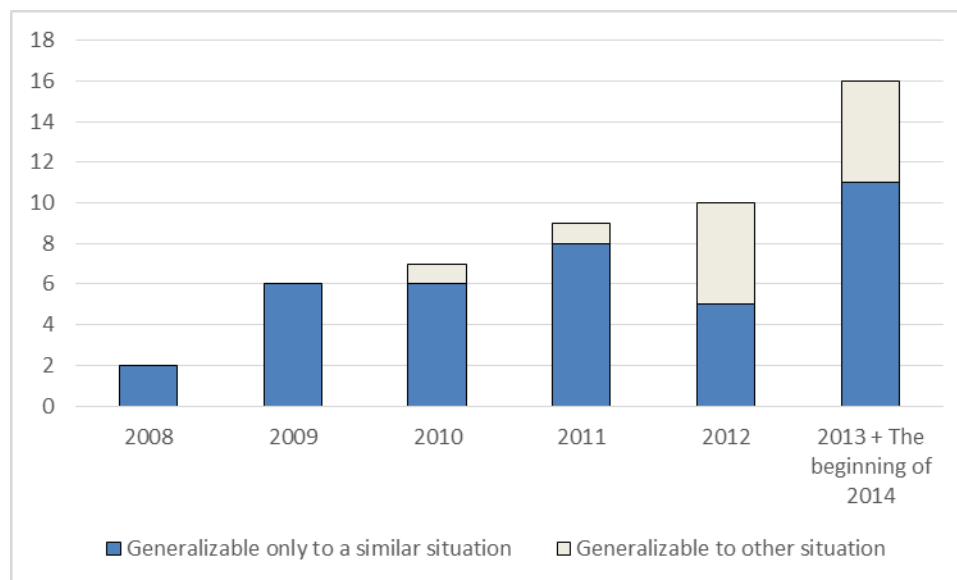

Fig. 2 Publications per year and how knowledge can be generalised from the reviewed articles

4.1. Factors Influencing the Decision to Crowdsource

We now report more detailed results from the systematic literature review. In particular, Table 3 highlights the factors influencing the decision to crowdsource and number of articles supporting and not supporting these factors. We find nine influencing factors, which are decomposed in sixteen sub-factors or properties. For each factor and sub-factor, we show the number of studies that suggest considering it when making a crowdsourcing decision.

We note that there may be a difference between the number of articles supporting a generic factor and the sum of the corresponding references in its sub-factors. The reason is that, in many cases, an article considers multiple sub-factors and thus was coded multiple times, e.g. ease of delineation and partition of task (Afuah & Tucci, 2012). In other cases, an article studies a generic factor as a whole, without considering its sub-factors, e.g. task (Saxton et al., 2013). We also found some factors negatively influencing the decision to crowdsource, such as risks. These were marked with a negative sign in Table 3.

Table 3: Factors influencing the decision to crowdsource

Factors	Sub-factors/ Factor's properties	No. of supporting articles	No. of non-supporting articles
Task		**30**	**1**
	Ease of delineation	10	
	Partitionable	8	
	Ease of integration with existing business processes	7	
	Done through the Internet	5	
	Confidential information (-)	3	1
	High interaction or requiring training (-)	2	
	Hard to be automated	1	
Availability of the crowd to perform the task		**19**	
	Number of members	9	
	Diversity	6	
	Knowledge	5	
	Internet access	3	
Risks (-)		**14**	**1**
	Low quality results (-)	8	
	Loss of intellectual property (-)	4	1
Infrastructure		**12**	
	Availability of crowdsourcing platform	10	
Expertise to manage the crowdsourcing activity		**6**	
Small budget		**4**	**4**
Lack of internal human resources to accomplish the task		**3**	
	Number of employees	3	
	Knowledge	2	
Lack of internal commitment (-)		**3**	
Slow in technology adoption (-)		**1**	

From Table 3, the results are that 'task' and its sub-factors are the most common factors affecting the decision to crowdsource. Of the 50 studies that were analysed, 30 suggest considering this factor under different names, including problems (Brabham, 2008; Muhdi et al., 2011), challenges (Seltzer & Mahmoudi, 2013), and crowd work (Kittur et al., 2013). The task factor is the salient concern because it is where the decision can be started with. Malone et al. (2010) considers "what is being done" (p. 24) as the first question to be answered when crowdsourcing. Further, the key influence of the task factor can also be seen via the fact that it determines several elements of crowdsourcing activities, including the targeted crowd, the chosen platform, and internal experts supporting crowdsourcing activities.

Given the key influence of the task factor, studies have examined several sub-factors to understand which tasks can be effectively sent to the crowd. We found 7 sub-factors of tasks influencing the decision to crowdsource. Four of them that were frequently cited are whether tasks are easy to delineate (10 articles), to partition (8 articles), to integrate with existing business processes (7 articles), and to be done through the Internet (5 articles). To a lesser extent, the results also indicate that the prospect to choose a crowdsourcing strategy decreases

when the task includes confidential information, requires high interaction, or can be automated.

The second most cited factor affecting the crowdsourcing decision is 'availability of the crowd for task', which was found in 38% of the reviewed articles. The crowd, which comprises the actors willing to perform a task, is one of the key underpinnings behind the crowdsourcing concept (Estellés-Arolas & González-Ladrón-de-Guevara, 2012; Howe, 2006; Schenk & Guittard, 2011). In relation to the crowdsourcing decision, the probability to crowdsource "depends on the characteristics of the crowd" (Afuah & Tucci, 2012, p. 366). This factor is characterized by four sub-factors: number of individuals, diversity, knowledge, and ability to access the Internet. Within these sub-factors, it is quite surprising that only 3 articles mention the Internet access requirement. Perhaps being online is assumed by the researchers as a given condition of crowdsourcing (Brabham, 2008; Howe, 2006; Saxton et al., 2013).

To a lesser extent, these results indicate that the decision to crowdsource is also influenced by other factors, including risks, infrastructure availability, internal human resources, budget, internal commitment, and the level of organisations' technology adoption. Within these factors, an interesting one is the budget factor as four articles suggest that a low budget is an antecedent to crowdsource, whereas an equal number of articles recommend that crowdsourcing activity should only be performed with a sufficient budget. In a closer look on this apparent disagreement, cost savings, on the one hand, is one good reason to adopt a crowdsourcing strategy (Maiolini & Naggi, 2011; Schenk & Guittard, 2011). On the other hand, other studies argue that cost savings may not be important when considering whether or not to crowdsource because hidden costs may increase during the crowdsourcing activity (Lu et al., 2015).

4.2. A Theoretical Framework to Support the Decision to Crowdsource

This section aims at building an analytical framework supporting the decision to crowdsource based on the factors identified in the previous section. To this end, we analysed and structured these factors in two steps. First, following the basic crowdsourcing assumption that a collective individuals are smarter than the few (Surowiecki, 2004), we suggest 'wisdom of the researchers' where a group of researchers is more intelligent than individual experts. Thus, we focused on factors that were proposed by multiple studies. As a result, factors suggested by only one study were eliminated, because such suggestion may be derived from an author's bias or from results emerging from a delimited context.

Second, the remaining factors have to be framed in a structured and manageable way. From a system's perspective, crowdsourcing can be regarded as a socio-technical system (Geiger et al., 2012; Zhao & Zhu, 2014), which involves interaction and connectivity between organisations, humans and technology. Adopting this perspective, we adapted the socio-technical view proposed by Vicente (1999, p. 11) to the crowdsourcing context and classified the remaining factors in four layers. The suggested layers include: 1) the task that an organisation wants to crowdsource; 2) the human capital or people who perform the task; 3) the management that plans and coordinates the task; and 4) the environment surrounding managerial decisions. These layers constitute a framework supporting the decision to crowdsource (Fig. 3).
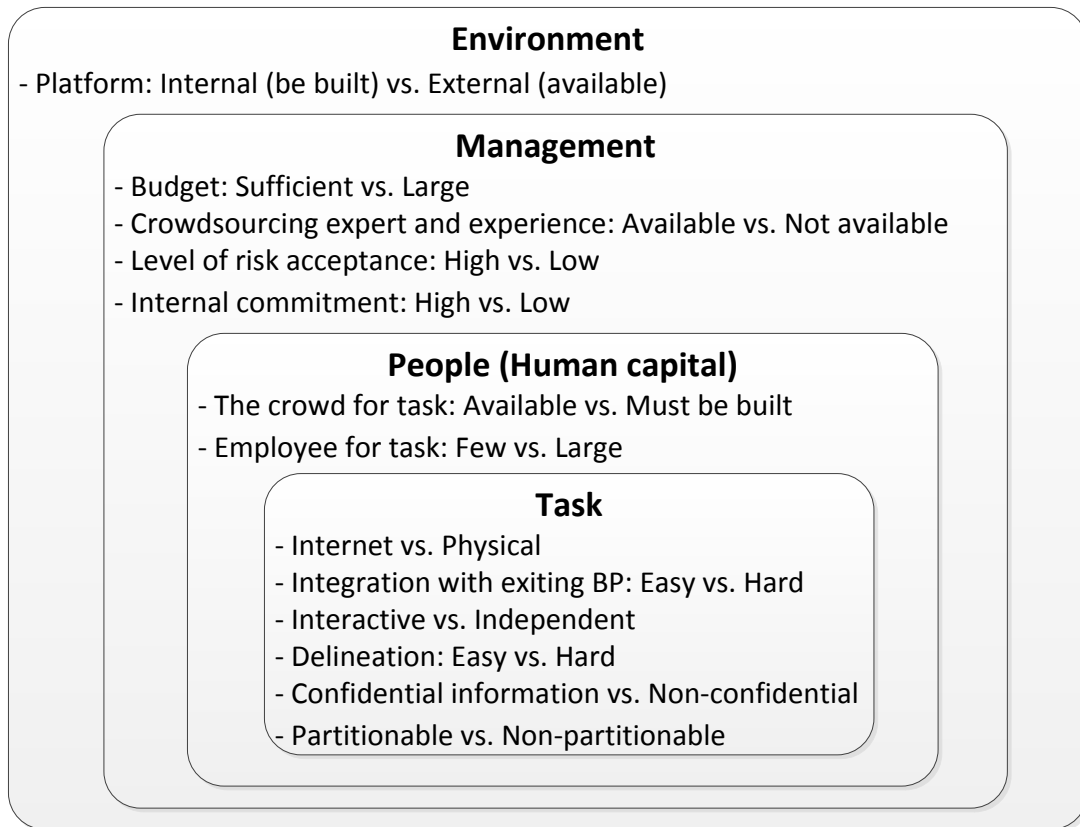
Fig. 3 A theoretical framework to support the decision to crowdsource (Adapted from (Vicente, 1999, p. 11))

Task Properties. We identified tasks as a primary factor in the decision to crowdsource. According to Kazman and Chen (2009), Zhao and Zhu (2014), and Rouse (2010), the crowd can be good for certain tasks, but not for all kinds of tasks. Muntés-Mulero et al. (2013), in the same vein, suggest considering task characteristics to evaluate whether a task is suitable to be crowdsourced or not. Considering this centrality, we position this factor in the innermost layer of the proposed framework. In this layer, six task properties are defined.

The first property is whether a task and its inputs/outputs can be delivered and collected through the Internet. Brabham (2008), Doan et al. (2011), and Muntés-Mulero et al. (2013) consistently suggest that crowdsourcing should only be used for Internet activities. Although this is not the most cited task property (as seen in Table 3), we note that such lack of relevance may be caused by taking this property for granted, as seen via the fact that the Internet is one of the key underpinnings of crowdsourcing activities (Estellés-Arolas & González-Ladrón-de-Guevara, 2012; Saxton et al., 2013; Schenk & Guittard, 2011). We could only find one exception in the related literature where a crowdsourcing task was not done over the Internet, but deployed through physical kiosks (Heimerl, Gawalt, Chen, Parikh, & Hartmann, 2012).

The second property is the possibility that crowdsourcing could be integrated with the existing organisational business processes. Although crowdsourcing tasks are accomplished outside organisations, several other tasks such as quality control and providing incentives to the crowd remain inside (Whitla, 2009; Zhao & Zhu, 2014). Thus, ease of integration is necessary to tighten and streamline the external tasks and internal business processes. This argument is supported by several reviewed articles, which do not only examine individualised crowdsourcing tasks but the whole business process (Kittur et al., 2013; Sakamoto, Tanaka, Yu, & Nickerson, 2011). The importance of this factor has increased recently since

crowdsourcing has already begun to be used for complex organisational tasks, such as development processes (Djelassi & Decoopman, 2013) and industrial problems (Muntés-Mulero et al., 2013).

The considered interaction property focuses on the relationship between the organisation and members of the crowd during crowdsourcing activities. In general, crowdsourcing does not seem suitable for interactive tasks that require frequent communication between the organisation and the crowd, or between the members of the crowd (Burger-Helmchen & Pénin, 2010). This is logical since the crowd members are independent agents and consequently it is quite hard to promote interaction (Afuah & Tucci, 2012). In a similar vein, Muntés-Mulero et al. (2013) also suggest avoiding a usage of crowdsourcing if complex training is required to fulfil a task. In other words, independent tasks that can be performed without a lot of interaction and training are more compatible to crowdsource.

'Ease of delineation' is a property, referring to how the task is defined. Ten out of fifty reviewed articles highlight the importance of this property. According to the reviewed research, organisations should adopt a crowdsourcing strategy when they have well-defined and clear-scope tasks (Lloret, Plaza, & Aker, 2012; Seltzer & Mahmoudi, 2013; Zogaj et al., 2014). The ease of delineation helps the crowd understanding and approaching to the task (Afuah & Tucci, 2012), which in turn maximises the potential number of individual contributions (Feller et al., 2012). We further note that tasks may be delineated with different levels of detail according to different stages of the crowdsourcing process (Muhdi et al., 2011). This means that the requirement for delineation may vary across different stages, from highly abstract in the decision to crowdsource to more specific in the design.

Since tasks are usually sent to anonymous members of the crowd, Muntés-Mulero et al. (2013) claim that tasks with confidential information, including privacy and security issues, and intellectual property considerations, are not suitable for crowdsourcing. Similarly, Burger-Helmchen and Pénin (2010), focusing specifically on crowdsourcing for-profit contexts, recommend that tasks should be crowdsourced only if intellectual property rights can be clearly defined. However, others believe that additional effort in task definition dealing with sensitive information may mitigate the problem. Feller et al. (2012) and Lu et al. (2015) suggest that organisations should decompose crowdsourcing tasks into a large number of smaller tasks to conceal the overall picture, thus decreasing the likelihood of privacy breaches and claims regarding intellectual property.

Finally, the ease with which a task can be partitionable into smaller pieces of work also affects the decision to crowdsource or not. Malone et al. (2010), when discussing the collective intelligence of the crowd, point out that a crowdsourcing strategy is more adequate for tasks that can be partitioned. Afuah and Tucci (2012) hypothesise that problem modularity positively influences the probability of choosing a crowdsourcing strategy. This property also indirectly affects the decision to crowdsource through strengthening the other aforementioned properties. In particular, partitionable tasks are expected to be easier to delineate (Feller et al., 2012) and to protect sensitive information (Lu et al., 2015).

People (human capital). When making the decision to crowdsource, an organisation should consider the chances of engaging human capital to do the task, in terms of the crowd members and internal human resources (Afuah & Tucci, 2012). Regarding the availability of the crowd members, crowdsourcing tasks must compete for the crowd's attention. In general, the high availability of members increases the chances of adopting a crowdsourcing strategy (Djelassi & Decoopman, 2013; Doan et al., 2011). Both Afuah and Tucci (2012), examining crowdsourcing contests, and Malone et al. (2010), focusing on collective intelligence,

identify a positive influence between the availability of crowd for tasks and the decision to crowdsource.

According to Table 3, four sub-factors influencing the availability of the crowd are the number of members in the crowd, Internet access, knowledge, and diversity. Within these sub-factors, the number of members, who are suitable for the organisational task, and their ability to access the Internet can be seen as two determinants for availability. Both Malone et al. (2010) and Marjanovic et al. (2012) indicate that having a large pool of people to procure for a task increases the chances an organisation will crowdsource. The importance of Internet access within the targeted crowd is related to the fact that tasks being crowdsourced are almost all Internet tasks, as mentioned earlier. As a result, Internet access influences the number of participants available for crowdsourcing tasks (Brabham, 2008; Saxton et al., 2013), and thus positively affects the crowdsourcing decision. The role of the other two sub-factors, i.e. knowledge and diversity, seem to depend on the nature of task. For instance, some tasks, such as software testing (Tung & Tseng, 2013), require the crowd members to have a certain type of knowledge, while others, such as solving a generic problem (Feller et al., 2012), need a crowd with diverse backgrounds. In short, organisations making the decision to crowdsource should examine "the constant availability of sufficient quantity and quality [knowledge and/or diversity] of online workers" (Corney et al., 2010, p. 244).

Considering the availability of internal employees, Malone et al. (2010) suggest choosing crowdsourcing when an organisation has too few internal employees to deploy the task. Lu et al. (2015) go further to recommend that this fewness should be seen in terms of both number of employees and their knowledge for tasks. With some tasks like text transcription and image labelling requiring a large number of human resources that often exceed an organisation's capability, crowdsourcing is a preferred option. For example, a recent project that aimed to transcribe 41 diaries written over 21,000 days and thousands of prints found that "[they] can't do the project with existing human resources" (Kingston, 2013, p. 16) and consequently, crowdsourcing was a good (if not the only) option. Afuah and Tucci (2012) agree with Malone et al. (2010) but view internal human resources in terms of knowledge required for tasks. Thus, they recommend using crowdsourcing in case "the knowledge required to solve the problem falls outside the focal agent's knowledge neighbourhood" (Afuah & Tucci, 2012, p. 369).

To sum up, our review suggests that both high availability of the crowd and scarcity of internal employees for the organisational tasks lead to crowdsourcing. In comparison between these two factors, the former should receive higher priority for two reasons. First, the crowd is one of the key actors in a crowdsourcing system (Zhao & Zhu, 2014), and thus its role is highlighted by many studies, i.e. nineteen studies in the reviewed pool, compared to three studies suggesting the role of scarce internal employees. Second, although organisations may have enough internal human resources to perform tasks, approaching the crowd can bring competitive advantages for the organisations, e.g. increasing customer relationship. This can be inferred from many crowdsourcing projects promoted by well-resourced organisations, like Westpac bank (Westpac, 2013) and several medium and large organisations mentioned by Lüttgens et al. (2014).

Management. Crowdsourcing adoption is a complex decision process, which has to receive major attention from managers (Djelassi & Decoopman, 2013). Consequently, several managerial issues influencing the decision to crowdsource need to be clarified. Rouse (2010) advises "the [a] decision to crowdsource should only be made" (p. 8) after examining costs, coordination, and risks. Recent studies additionally suggest concerning employees' commitment in the decision to crowdsource (Lüttgens et al., 2014; Simula, 2013).

Consequently, the management layer in our framework (Fig. 3) focuses on four factors: the project budget, the availability of expertise to manage the crowdsourcing activity, risks, and organisational employees' commitment.

In the decision to crowdsource, organisations evaluate whether the crowdsourcing strategy, when compared to other alternatives, is more or less efficient realising organisational goals. One important criterion for measuring efficiency is cost savings (Muhdi et al., 2011), and thus the budget of a crowdsourcing project influences the decision to crowdsource. As discussed in the previous section, there is a disagreement between the reviewed articles on this factor. While some studies support that crowdsourcing is preferred when a project does not have enough money to hire new employees, or is a small-budget project (Malone et al., 2010), others argue that a reasonable budget is required because although the amount of money to pay the crowd may be small, other costs, like coordination and transaction costs, may increase (Lu et al., 2015). Although further studies are needed to solve this disagreement, we suggest that projects with sufficient budget should be crowdsourced, and the term sufficiency here means that the budget is not enough to perform tasks in the traditional way, i.e. internal sources and outsourcing, but sufficient to cover the crowdsourcing activities.

Besides budget, crowdsourcing can only succeed if organisations allocate appropriate expertise and experience to coordinate its activities. In particular, Muhdi et al. (2011) state that at the beginning of a crowdsourcing project, "a source of experience and expertise in crowdsourcing can be helpful to match company expectations and the realistic possibilities of crowdsourcing" (p. 323). In other words, Rouse (2010) suggests that poor coordination can lead the project to a drain of resources and substantial delays. Similarly, other studies stress the importance of expertise managing different aspects of crowdsourcing, such as workflow management (Curran, Feeney, Schaler, & Lewis, 2009; Erickson & Trauth, 2013), members management (Dow et al., 2011), and quality control management (Maiolini & Naggi, 2011).

By analysing the reviewed papers, we have identified a few risks that should be considered when deciding to crowdsource. Following Souza (2009) to distinguish between "the minor acceptable risks from the major risks" (p. 8), we focus on the most salient risks revealed by the literature. They are risks of low quality results (Kannangara & Uguccioni, 2013; Naroditskiy et al., 2013) and loss of intellectual property (Kannangara & Uguccioni, 2013; Schenk & Guittard, 2011). Since the members of the crowd perform tasks voluntarily, organisations do not have the same level of control over members' behaviour as they would have over their own employees (Zhao & Zhu, 2014), and this could lead to poor contributions to the project. Things become worse in the context of for-profit crowdsourcing, where malicious behaviours cannot be prevented (Naroditskiy et al., 2013). Consequently, the risk of low quality results should be considered. Another risk is loss of intellectual property (Marjanovic et al., 2012), which mainly links to skilled tasks. When crowdsourcing these types of tasks, knowledge may have to be transferred to the crowd (Afuah & Tucci, 2012); and after the tasks are accomplished, knowledge related to the task may remain in the crowd. Considering this risk, Burger-Helmchen and Pénin (2010) claim that crowdsourcing is only a viable alternative if intellectual property can be managed. It is worth noting that managing intellectual property is not only limited to hiding sensitive information, as aforementioned in the task layer, but can be extended to other concerns, such as patents (Burger-Helmchen & Pénin, 2010) and intermediary platforms (Feller et al., 2012). In summary, organisations that can accept and manage the risks of low quality results and loss of intellectual property have more chance of deciding to crowdsource.

The fourth and final factor we consider in this layer is the organisational employees' commitment to crowdsourcing activities, a concern suggested by recent studies (Lüttgens et al., 2014; Simula, 2013). This factor refers to the conflicting interests of employees and managers regarding the crowdsourcing activity, which relates to overcome the issue of the 'not invented here syndrome' (Katz & Allen, 1982). Although only a few articles in our review consider this factor, we believe that they raise an important managerial concern because failing to have organisational employees' commitment "can jeopardise the success of an entire crowdsourcing project" (Muhdi et al., 2011, p. 322). Another reason is that several tasks within a crowdsourcing project, such as defining tasks and providing incentives, are performed internally by organisational employees and managers (Whitla, 2009; Zhao & Zhu, 2014), and thus a lack of their commitment may decrease the ability to choose a crowdsourcing strategy (Lüttgens et al., 2014).

Environment. The choice between internal or external crowdsourcing platforms plays a role in the crowdsourcing decision. In terms of cost, which is one reason to choose crowdsourcing (Zhao & Zhu, 2014), using an external platform can decrease development costs, which makes the decision to crowdsource become more attractive. From a resource-based view, Lu et al. (2015) emphasise the impact of the external platforms in making the decision to crowdsource, as seen in "decisions on the use of online microsourcing [crowdsourcing] will be driven by the ability of online sourcing platforms to provide cheap service solutions, complement current resources, fill a resource gap, and to give access to a large pool of resources" (p. 4). In the same vein, Zogaj et al. (2014) indicate that available platforms enable access to different pools of members, which relates to the decision to crowdsource. For example, Amazon Mechanical Turk has approximately 100,000 members (Mason & Suri, 2012), a pool size that organisations would struggle to build individually. The use of the available crowdsourcing platforms is also supported by other studies (Chanal & Caron-Fasan, 2010; Feller et al., 2012).

5. Discussion and Suggestions

Based on the proposed framework (Fig. 3), we now derive some practical implications that can be applied to the decision to crowdsource. These are presented in a precise and compact way using decision tables, which are regarded as the most effective presenting technique in terms of interpretability, when compared to decision trees, propositional rules, and oblique rules (Huysmans, Dejaeger, Mues, Vanthienen, & Baesens, 2011). The adoption of decision tables has also been suggested for their consistency, completeness, and correctness (Baesens, Setiono, Mues, & Vanthienen, 2003; Vanthienen & Wets, 1993). However, we understand that this technique has been criticised for a lack of traceability and that tables may become too large in complex problems (De Roover & Vanthienen, 2011). Addressing the problem of too large decision tables, we used the layers of our framework to structure the identified factors. As a result, factors in each layer were summarised as a decision table, avoiding the problem of having one large decision table. To increase traceability, we added a row in the end of each decision table presenting the references that explain the link between a specific condition and the corresponding implication (see Table 4-6). To sum up, recommendations for making the decision to crowdsource are presented as a series of decision tables arranged according to the four layers of the framework. An exception is the Environment layer, which has only one factor and thus does not need a separate table.

As the heart of the framework, task properties and related implications are presented in the first decision table (Table 4). According to our review, managers should only choose to crowdsource tasks that satisfy three conditions: (1) can be done through the Internet

(Brabham, 2008; Estellés-Arolas & González-Ladrón-de-Guevara, 2012; Muntés-Mulero et al., 2013); (2) are easy to integrate with the organisations' business processes (Kittur et al., 2013; Sakamoto et al., 2011); and (3) require few interactions (Afuah & Tucci, 2012; Burger-Helmchen & Pénin, 2010; Muntés-Mulero et al., 2013). In addition, tasks should be well defined, either in the decision to crowdsource or in the latter stages of the crowdsourcing process, e.g. during configuration (Lloret et al., 2012; Muhdi et al., 2011; Zogaj et al., 2014). In case tasks include confidential information, additional actions hiding sensitive information are necessary (Feller et al., 2012; Lu et al., 2015). Finally, tasks that can be partitionable into small pieces of work have more probability of crowdsourcing (Afuah & Tucci, 2012; Malone et al., 2010). One can argue that several crowdsourcing cases still succeeded with big contest tasks, which are not necessarily divisible. However, if these tasks can be modularised, "it may be easier for the focal agent to articulate a module" (Afuah & Tucci, 2012, p. 363), and thus the original goals are more likely to be reached.

Table 4. Decision table for layer 1: Task Properties

Condition: *Task properties*											
Internet: No (N) vs. Yes (Y)	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Ease of integration with existing BP	-	N	Y	Y	Y	Y	Y	Y	Y	Y	Y
Interactive	-	-	Y	N	N	N	N	N	N	N	N
Ease of delineation	-	-	-	Y	Y	Y	Y	N	N	N	N
Confidential information	-	-	-	Y	Y	N	N	Y	Y	N	N
Partitionable	-	-	-	Y	N	Y	N	Y	N	Y	N
Action											
Not to crowdsource	X	X	X								
Should crowdsource						X					
Crowdsource with additional action (CSwAA): clearly define task in the latter stages of the crowdsourcing process								X	X	X	X
CSwAA: define tasks hiding confidential information				X	X			X	X		
CSwAA: only crowdsource as a contest					X		X		X		X
References (to article number in Appendix A)	3,8, 24	15,31	1,4	11,18	3,11,18	41, 50	3		11,18	3,11,18,23	16,23	3,16,23

Table 5 presents the role of human capital playing within the crowdsourcing process, considering the availability of the crowd and organisational employees. The literature in our review has widely agreed that the capability to massively approach the crowd members is a pre-condition for crowdsourcing (Djelassi & Decoopman, 2013; Doan et al., 2011; Saxton et al., 2013). As discussed in the previous section, this condition is understood as reaching a large number of members through the Internet, who have appropriate knowledge or/and diversity regarding crowdsourcing context. To approach the crowd members, organisations, depending on the crowdsourced tasks, can choose a general crowd (Brabham, 2009), its customers (Djelassi & Decoopman, 2013), and members of a particular crowdsourcing platform, e.g. Amazon Mechanical Turk and Innocentive. Discussion on how to attract crowdsourcing members can be found in the work by Tokarchuk et al. (2012) and De Vreede et al. (2013).

This table also suggests considering the availability of internal employees when deciding to crowdsource. We follow Afuah and Tucci (2012) advise that organisations should crowdsource in cases they have too few internal employees to accomplish the task and cannot allocate this resource in its neighboured agent. This advice is consistent with a resource-based view, as seen via "when a firm finds that its internal [human] resources and capabilities cannot satisfy the company's strategic objectives, the external acquisition of complementary resources and capabilities becomes necessary" (Lu et al., 2015, p. 5). Finally, if both conditions in Table 5 are satisfied, i.e. both crowd members and internal employees are available to perform the task, we suggest that crowdsourcing is still a good option, but advice considering other factors such as task properties and management factors.

Table 5. Decision table for layer 2: People

Condition: *People (human capital)*			
The crowd for task: Available (A) vs. Not available (N)	N	A	A
Employee for task: Few (F) vs. Large (L)	-	F	L
Action			
Not to crowdsource	X		
Should crowdsource		X	
CSwAA: consider other factors			X
References (to article number in Appendix A)	7,8	7,8,18	1,7,8

The factors in the management layer are summarised in Table 6. Some organisations, such as Wikipedia and non-profit organisations (Brabham, 2009), demonstrate that they can crowdsource with little or no money. However, recent studies suggest that a sufficient budget is required (Djelassi & Decoopman, 2013; Lofi, Selke, & Balke, 2012; Lu et al., 2015). Although the cost of crowdsourcing activities is usually small, the cost of related activities like incentive mechanisms and quality control may be significant. Other costs, such as IT service costs, coordination costs, and adoption costs, that are important in outsourcing decision (Martens & Teuteberg, 2012) may also be relevant to the decision to crowdsource. Consequently, crowdsourcing should be chosen when the budget is not enough to perform the tasks in a traditional way (Malone et al., 2010) but sufficient to cover for the entire crowdsourcing process (Lu et al., 2015). In addition, crowdsourcing also needs the availability of good expertise and experience coordinating activities (Muhdi et al., 2011; Rouse, 2010). As a result, if a project has limited or no prior crowdsourcing expertise, hiring outside experts should be considered. In case the hire of experts cannot be arranged due to limited budget, it should not be crowdsourced.

The fact that crowdsourcing relies on anonymous members of the crowd originates several risks, including low quality results (Kannangara & Uguccioni, 2013; Naroditskiy et al., 2013) and loss of intellectual property (Kannangara & Uguccioni, 2013; Schenk & Guittard, 2011). Thus, we suggest in cases organisations have low level of acceptance related to these risks, mechanisms for risk control should be implemented. To manage the risk of low quality results, organisations can choose two types of quality control mechanisms: design-time and run-time (Allahbakhsh et al., 2013). At design time, organisations should prepare well requirements for tasks, e.g. the results are easy to be evaluated (Afuah & Tucci, 2012). Additionally, they should implement run-time quality control mechanisms, which can be generally categorised into three main approaches: using experts, using the crowd, and relying on third-party organisations (Zhao & Zhu, 2014). Addressing the risk of losing intellectual

property, a popular strategy is partitioning tasks into small pieces of work, so that the whole picture remains unrevealed (Lu et al., 2015; O'Neill, Roy, Grasso, & Martin, 2013). Other controlling methods are also available, such as using patents (Burger-Helmchen & Pénin, 2010) and intermediary platforms (Feller et al., 2012).

With an increased attention on crowdsourcing, internal employees may develop a fear of potentially losing their jobs (Brabham, 2008), leading to reluctance or low commitment to crowdsourcing. This low commitment creates barriers for crowdsourcing (Lüttgens et al., 2014; Simula, 2013). To increase internal commitment, Lüttgens et al. (2014) suggest identifying and empowering key individuals, who should drive the crowdsourcing project and motivate other employees. We also suggest restructuring the internal incentive systems and strategic budgeting, similar to what has been done in open innovation to overcome employees' negative attitudes (Huston & Sakkab, 2006). For instance, an incentive scheme rewarding the employees and managers that successfully support crowdsourcing projects may increase internal commitment.

Table 6. Decision table for layer 3: Management

Condition: *Management*													
Budget: Sufficient (S) vs. Large (L)	S	S	S	S	S	L	L	L	L	L	L	L	L
Crowdsourcing expert: Available (A) vs. Not available (N)	N	A	A	A	A	A	A	A	A	N	N	N	N
Acceptance level of risk: High (H) vs. Low (L)	-	H	H	L	L	H	H	L	L	H	H	L	L
Internal commitment: High (H) vs. Low (L)	-	H	L	H	L	H	L	H	L	H	L	H	L
Action													
Not to crowdsource	X												
Should crowdsource		X			X								
CSwAA: hire outside experts (due to large budget)										X	X	X	X
CSwAA: implement mechanisms for controlling risks				X	X			X	X			X	X
CSwAA: implement strategies for increasing internal commitment			X		X		X		X		X		X
References (to article number in Appendix A)	7, 17, 18	18, 30	19	12	12, 19	18, 30	19	12	12, 19	18	18,19	12,18	12,18,19

Finally, as the lone environmental factor, the crowdsourcing platform availability should also be evaluated. Although organisations can build their own platforms, immediate availability of platforms is often critical when choosing a crowdsourcing approach (Chanal & Caron-Fasan, 2010; Lüttgens et al., 2014; Zogaj et al., 2014). Some reasons to adopt external platforms are the large pool of crowd members (Mason & Suri, 2012), reducing setup efforts (Wang et al., 2013) and, in some cases, protecting intellectual property (Feller et al., 2012). Agreeing with these benefits, we further note that the existing platforms can be distinguished into specialised and horizontal platforms. Specialised platforms focus on particular tasks, e.g.

InnoCentive for problem solving tasks (Hirth, Hoßfeld, & Tran-Gia, 2011), and thus have their own specialised members. On the other hand, horizontal platforms, like Amazon Mechanical Turk, having diverse members can be utilised for different types of crowdsourcing tasks (Kucherbaev et al., 2013). This distinction may also influence the choice of using existing platforms. For instance, a crowdsourcing activity with multiple dissimilar tasks should be deployed on a horizontal platform. Further discussion on the distinction can be found in the work by Hoßfeld et al. (2013) and Kucherbaev et al. (2013).

6. Conclusion and Limitations

Using the systematic literature review, the focus of this paper was to identify factors that influence the decision to crowdsource. We suggest that by focusing on these factors, organisations can evaluate their readiness for crowdsourcing, and thus may leverage the competitive advantages of a crowdsourcing strategy. We then arranged the identified factors into the four-layer framework addressing task, people, management, and environmental issues. The framework proposed in this paper provides not only a good starting point for academics, who are interested in following up one or more influencing factors discussed in this paper, but important implications to benefit practitioners when choosing crowdsourcing. Thus, this study should be important from both academics and practitioners' perspective.

From the academics' view, this research responds to the calls for further investigation over "factors that influence crowdsourcing adoption" (Zhao & Zhu, 2014, p. 427). Although multiple factors needing consideration in the decision to crowdsource have been highlighted in the literature (Lüttgens et al., 2014; Muhdi et al., 2011), very few studies have tried to analyse them. Focusing on the research question 'what factors influence an organisation's decision to crowdsource?', our study aimed to build a broad picture of what the literature has reported on these factors. As a result, we identified and analysed nine factors and sixteen sub-factors impacting the decision to crowdsource.

Our work also identified the relationships between the identified factors, which are not apparent in individual studies. It can be seen that the researchers of the reviewed papers have chosen different levels of granularity upon their studies on the decision to crowdsource. Some of them, such as Sharma (2010) and Muhdi et al. (2011), chose an abstract level and focused on generic factors. Others, such as Afuah and Tucci (2012), examined more specific sub-factors. Such diverse partly explains the existence of different lists of factors proposed in the reviewed studies, leading to the necessity to analyse the relationships between these factors. Examining these relationships in the current study allows us synthesising these factors and sub-factors into the generalised framework (Fig. 3). Further, as this framework classified and structured the factors influencing the decision to crowdsource into the corresponding layers (task, people, management, and environment), it can be seen as a taxonomy for making crowdsourcing decision, contributing to organise knowledge in the crowdsourcing field (Nickerson et al., 2012).

Methodologically, The systematic approach adopted in this study addresses the need for systematically reviewing IS literature, including crowdsourcing literature, as seen via "information systems scholars tend to be unaware of the need for structure in literature reviews" (Okoli & Schabram, 2010, p. 1). From another aspect of IS literature reviews, our method suggested a descriptive literature analysis. According to King and He (2005), there are four commonly employed review methods in IS literature reviews, including narrative reviews, descriptive reviews, vote counting, and meta-analysis. Narrative reviews present qualitative interpretation of past studies; descriptive reviews that include some qualification identify trends and patterns in the surveyed literature through a systematic procedure (e.g.

Yang & Tate, 2012); vote counting "is applied to produce a single quantitatively synthesised conclusion from a series experiments" (King & He, 2005, p. 668); and meta-analysis statistically combines and analyses quantitative outcomes of existing empirical studies. Since our study adopted a systematic method to reveal interpretable patterns and trends in the 'decision to crowdsource' body of literature, it was aligned with the descriptive literature analysis.

From the practical view, our study provides insights for organisations, i.e. managers and decision makers, to evaluate whether crowdsourcing is appropriate within the organisational context (Muhdi et al., 2011). Based on our results, we suggest this evaluation should be based on the identified factors organised along the four-layer decision framework. Consequently, organisations can consider the current nature of these factors within their contexts and prepare for crowdsourcing. By presenting our results as a series of decision tables, managers are provided with actionable guidelines when making a crowdsourcing decision (Section 5). These actions include not only the choice to crowdsource or not, but also additional activities that may increase or decrease the probability to crowdsource. These tables can also be used as a practical tool to understand and evaluate an organisation's decision to crowdsource.

Although the results presented in this paper are mostly important to organisations, who want to adopt a crowdsourcing approach, these results are also relevant to crowdsourcing platforms. Through our framework, platform developers can understand the focused concerns of the crowdsourcing organisations, which are the main customers of the platforms, in order to build appropriate functions for the crowdsourcing platforms. For instance, our framework, aligned with Vukovic and Bartolini (2010), suggests that supporting the integration between crowdsourcing activity and the internal business process is one key requirement for crowdsourcing, and thus business process management functions should be developed in the crowdsourcing platforms.

Through a critical lens, this study still inevitably has certain limitations. First, as common with a systematic literature review, our results are based on data gathered from the literature, and thus bias, limitations and validity issues of the references may also apply to this study (Kitchenham, 2007). Understanding this concern, we applied what we called the 'wisdom of the researchers' to partly overcome the limitation by focusing on factors proposed by multiple studies. Second, while our review focused on academic articles, the decision to crowdsource may be discussed on organisational presentations, reports, websites, and news media (e.g. Holley, 2010; Kingston, 2013). Consequently, we suggest that future research should extend the scope of the review to alternative sources of information, namely documents from practitioners.

Third, although our framework considered several decision factors that were salient in the existing crowdsourcing literature, future research could explore the impacts of other factors. For instance, ethical aspects, which play a role in IT professionals (Stoodley, Bruce, & Edwards, 2010), and sustainability and greening, which became crucial for making a strategic IT decision (Bai & Sarkis, 2013), could also be significant on the decision to crowdsource. Finally, we foresee that the identified factors may also influence other stages of the crowdsourcing process, e.g. task design and platform configuration. Thus, future research should explore these influences to enable a more comprehensive framework supporting the whole crowdsourcing process.

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Appendix A: List of Reviewed Articles

No	References
1	Afuah, A., & Tucci, C. L. (2012). Crowdsourcing as a solution to distant search. *Academy of Management Review, 37*(3), 355-375.
2	Alonso, O. (2013). Implementing crowdsourcing-based relevance experimentation: an industrial perspective. *Information Retrieval, 16*(2), 101-120.
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Appendix B: Coding Form

General information

Data item	Value
Article	
Year of publication	
Date of coding	
Note	

Topics and findings

Data item	Value	
Main topics	☐ Circumstance to crowdsource & Influencing factors	☐ Benefits & Opportunities
	☐ Capabilities & Characteristics of crowdsourcing	☐ Risks & Challenges
	☐ Position of the decision to crowdsource within the crowdsourcing process	
	Other topics:	
Research findings	Main findings	
	Other findings	
	Knowledge generated from the findings	☐ Generalizable to other situation ☐ Generalizable only to a similar situation

Practical outcomes

Data item	Value		
Crowdsourcing contexts	Applications	☐ Profit vs. Non-profit ☐ Profit ☐ Non-Profit ☐ N/A	
		Function	☐ Design & Development ☐ Idea & Consultant ☐ Test & Evaluation ☐ Other
	Tasks	Participation mode	☐ Individual (Integrative) ☐ Competitive (Selective) ☐ N/A
		Complexity	☐ Simple ☐ Skilled ☐ N/A
	Other contexts		
Practical recommendations for making crowdsourcing decision			