Toward a Nexus Model Supporting the Establishment of Business Process Crowdsourcing

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Abstract. Crowdsourcing is an emerging strategy that has attracted attention from organizations for harvesting information, labour, expertise and innovation. However, there is still a lack of a way to establish crowdsourcing as an organizational business process. Adopting a design science paradigm, the current study fills the gap by building a model supporting the establishment of business process crowdsourcing. In particular, we combined a structured literature review method, identifying individual components of business process crowdsourcing, and the design theory nexus, connecting these identified components. Our results identify twelve components that were widely proposed by the literature. These components are structured into a preliminary model concerning three stages of business process crowdsourcing: the decision to crowdsource, design, and configuration. Discussions on each component of the model and related implications are provided.

Keywords: Business process crowdsourcing, crowdsourcing, design science, nexus model, structured literature review

1 Introduction

With the development of information technology that enables an online global workforce [1], many organizations have begun to shift from a strategy of inner-sourcing and outsourcing to a strategy of crowdsourcing. Crowdsourcing, which utilizes mass individuals in the crowd to perform specific tasks [2, 3], has attracted attention from the organizations for gaining information, skills, and labour, and reducing cost [4, 5]. Consequently, the list of organizations adopting a crowdsourcing strategy has become longer, including Threadless, iStockPhoto, Amazon, Boeing, Procter and Gamble, Colgate-Palmolive, Unilever, L'Oreal, Eli Lilly, Dell, Netflix, and Lexus [2, 5].

While early literature has demonstrated the success of several crowdsourcing initiatives, recent literature has emphasized that organizations need to build dedicated business processes to effectively utilize the crowdsourcing business model [6]. In crowdsourcing, although tasks are performed outside organizations, several other activities, such as task definition and quality control, remain inside [7]. Thus, it is necessary to establish crowdsourcing as an organizational business process, namely

business process crowdsourcing (BPC) [8], which tightens and streamlines the external and internal activities. This establishment has become more significant recently as crowdsourcing was used for complex organizational processes, such as product development [6].

Yet, in terms of establishing an approach to BPC, crowdsourcing has not been transferred from an emerging strategy to common practice. The current lack of a way to establish BPC has been identified by several researchers [9-11]. In particular, Vukovic et al. [11] state that one major challenge in the crowdsourcing domain is "how does crowdsourcing become an extension of the existing business process" (p. 7). Similarly, Khazankin et al. [9] recently noted the lack of a way to execute BPC, i.e. as repeated organisational practice. Consequently, the following research question needs to be further investigated.

Research Question: How to support the analysis, design, and configuration of business process crowdsourcing?

To address the research question, the current study aims to develop a model supporting the establishment of BPC. According to Aalst and Hee [12], a business process is defined as a number of tasks and a set of conditions determining the order to perform these tasks. Adopting this definition, the current study examines BPC as the overall coordination of internal tasks and crowdsourcing tasks. Effective coordination involves 1) classification of tasks across entities (e.g. between internal and external entities), where tasks corresponding to an entity comprise a sup-process, referring to a component in the 'to-be-built' model; and 2) integration of these sub-processes to execute the entire business process.

Although there are currently no frameworks for supporting the establishment of BPC, the literature has investigated these two aspects of BPC separately. In the first aspect, a large number of crowdsourcing studies have examined diverse topics within a particular crowdsourcing sub-process, including crowd management [13] and quality control [14]. However, these studies mostly focus on isolated aspects [15] and examine a crowdsourcing sub-process in an ad-hoc manner [16]. Addressing the second aspect, a few studies chose an integrated view and proposed several linked sub-processes or components of BPC [17, 18]. However, different studies suggest different lists of components, making it difficult to establish a common framework supporting the planning, analysis, designing and configuration of BPC.

Fulfilling this gap, the objective of this study is twofold. First, we want to identify and analyse what components constitute BPC. Second, we aim to integrate these components into a model supporting the establishment of BPC. To design this model, the current study followed a design science paradigm [19]. In particular, our research method combines a structured literature review method (SLR) [20] with the design theory nexus (DTN) [21]. While a SLR enables the formation of a knowledge base for developing a design science artifact [22, 23], the DTN can "connect numerous design theories with alternative solutions" (p. 1) [21] that result from the SLR. As a result, this combination helps to systematically identify and synthesize individual findings from the related literature into components comprising a BPC model.

By doing so, this study contributes to knowledge by consolidating our understanding on how to establish crowdsourcing as an organizational business

process, addressing the current lack of a way to organize business processes based on crowdsourcing [9]. Another contribution of this study is to develop a model supporting the establishment of BPC. As this model is developed by incorporating the most significant findings highlighted in the BPC literature, it overcomes the ad-hoc manner emphasized by the crowdsourcing literature [15, 16]. From a practical point of view, our research provides practical implication on how to analysis, design and deploy BPC, which moves forward the application of crowdsourcing in practice.

2 Background

2.1 Concept of Crowdsourcing

Since the term 'crowdsourcing' was first coined by Howe [2], referring to a strategy utilizing mass individuals to perform specific tasks in form of an open call, this concept was conceptualized by several researchers. Many of them conceptualized crowdsourcing by comparing this notion with similar concepts, including open innovation, outsourcing, and open source [4, 24, 25]. Within these concepts, crowdsourcing has often been classified to the open innovation paradigm, where organizations harvest knowledge and expertise from the outside, as opposite to closed innovation. However, Schenk and Guittard [24] stress two important differences between crowdsourcing and open innovation. The first one is that open innovation only focuses on innovative processes, while crowdsourcing can be used for varied types of tasks. Second, organizations explicitly interact with other firms and their customers in open innovation, but rely on members of the crowd in crowdsourcing activities [7].

Although organizational demands to use external agents are similar in crowdsourcing and outsourcing [2, 25], the differences between them can still be clearly identified. A major difference lies in the manner of who performs the activities. Actors performing tasks in crowdsourcing are members in the crowd, while they are supplier firms in outsourcing [24]. This leads to the second difference of managing these actors. Compared to official contracts with some preselected suppliers in outsourcing, crowdsourcing uses an open call to popularise the tasks [2, 7]. Finally, motivation for task performers in crowdsourcing is based on not only financial incentives as in outsourcing but diversity, including both intrinsic (e.g. love of community) and extrinsic motivation (e.g. financial incentives) [26].

It is also necessary to distinguish crowdsourcing from open source. Although both concepts rely on the power of the community to accomplish tasks, Brabham [4] suggests distinguishing these two concepts in terms of how the activities can be managed and performed. In crowdsourcing, organizations manage their workflows, whereas in open source, these activities are driven by the community. Examining how activities are performed, Zhao and Zhu [7] note that crowdsourcing outcomes can be achieved either independently or collaboratively, but open source's outcomes can only be achieved through collaboration. Furthermore, unlike open source, crowdsourcing has clearer ownership and does not restrict to software [24]. Given the above discussion, it can be stated that crowdsourcing is a distinctive notion, and thus the current study investigates crowdsourcing as a concept *per se*.

2.2 Business Process Crowdsourcing

The term Business Process Crowdsourcing (BPC) was first introduced by Vecchia and Cisternino [8] as an alternative to business process outsourcing. Etymologically, BPC combines the word *crowdsourcing*, utilizing the crowd to perform particular jobs (Section 2.1), with the phrase *business process*, referring to a number of tasks and the coordination of these tasks [12]. Thus, BPC should be examined as both a number of individual tasks across crowdsourcing entities, and the coordination of these tasks forming an entire business process.

The literature has highlighted several roles of BPC in crowdsourcing activities. First, BPC can help streamline internal and external tasks in the crowdsourcing process. In other words, the lack of an integrated workflow to link these tasks is an obstacle for crowdsourcing applications [9]. Second, BPC can preserve the knowledge necessary to accomplish several crowdsourcing tasks, like problem solving. Lopez et al. [10] state that "organizations require integration of the crowdsourced tasks with the rest of the business process. […] the solutions are never reintegrated to the enterprise causing knowledge to be lost" (p. 539). Finally, an establishment of BPC enables crowdsourcing to become a common organizational practice, as opposed to one-off projects.

In spite of its promise, how to establish BPC has not been fully examined in the literature. Khazankin et al. [9] identifie "the lack of an integrated way to execute business processes based on a crowdsourcing [platform]" (p. 1). Yet, these authors investigated only a part of the problem, which optimized task properties for supporting business process execution. Similarly, Satzger et al. [13] seek to help organizations "fully automate[d] deployment of their tasks to a crowd, just as in common business process models" (p. 67), but focus only on choosing suitable workers to perform tasks. As a result, the establishment of BPC still needs to be further investigated.

As previously mentioned, an investigation on how to establish BPC needs to consider both individual tasks of a crowdsourcing process and the integration of these tasks. Each of these two aspects has been explored separately in the crowdsourcing literature, but not in concert. In the first aspect, a large number of studies examine diverse topics of crowdsourcing tasks within a particular sub-process [13, 14, 27]. Though these studies provide several implications for establishing BPC, the overall picture is still unveiled due to their ad-hoc foci [15, 16]. As a result, various and disparate, sometimes conflicted, findings and sub-processes related to BPC exist in the literature, confusing organizations in their BPC establishment.

In the other aspect, although the integration of crowdsourcing process has featured in several studies, a comprehensive approach is still missing. For instance, Geiger et al. [17] propose crowdsourcing processes as a sequence of four components: preselection of contributors, accessibility of peer contributions, aggregation of contributions, and remuneration for contributions. As the names imply, these components, however are mainly related to the contributors or external processes, and thus do not clarify internal organisational sub-processes. Examining both internal and external processes, Hetmank [18] suggests other components of a crowdsourcing system, including user management, task management, contribution management, and workflow management. Although this study considers both internal and external components, it has quite a narrow view due to its chosen technical perspective [18].

In summary, while recent literature has emphasised the importance of standardising BPC, the diversity of perspectives around BPC have made this difficult. Additionally, these multiple perspectives across different disciplines have led to inconsistent findings and propositions, making it more difficult for the establishment of crowdsourcing practices. Addressing this gap, the current study aims to build a model supporting the establishment of BPC.

3   Method

To develop a model supporting the establishment of BPC, the current study followed a design science paradigm proposed by Hevner et al. [19]. In the design science paradigm, studies usually require a design method that guides the development of the artifact [19, 21] and a knowledge base that forms a background for the development [19, 28]. Although several design methods were proposed [19, 21, 28], the choice of using a particular method appears disparate in the existing literature, and seems to depend on the particular problems. In this study, as the establishment of BPC forms a wicked problem, in which a variety of views, sub-processes, issues and alternative solutions exist, we adapted a DTN proposed by Pries-Heje and Baskerville [21]. The DTN enables numerous design theories and different views to be connected [21], and therefore seems well-suited to consolidate the various views and individual foci existing in the crowdsourcing literature.

In addition, a design science study requires a suitable knowledge base, which can be populated with the research problem [19, 28]. However, crowdsourcing is a new research field [7], leading to the difficulty of finding a corresponding knowledge base for the establishment of BPC. This problem is not rare in design science [19]. Addressing the problem of non-existent knowledge base, several researchers suggest utilizing the best research evidence from the literature [22, 23]. It is worth noting that Pries-Heje and Baskerville [21], when proposing their DTN, also recommend "a survey of existing literature and findings" (p. 737-738) to identify the existing theories and solutions related to the targeted problem. Given the above discussion, the current study adapted and combined the DTN [21] and the SLR method [20].

Table 1 compares the stages of the current study with the equivalent stages of the DTN and SLR. As seen via Table 1, our method includes five stages: selecting articles, filtering articles, data extraction and classifying articles, data synthesis, and model building. These stages are based on and thus comparable to the SLR [20]. While based on the SLR, each stage in our method has a similar purpose compared to the steps of DTN that were summarized in column 3 of Table 1. In particular, our three first stages aim at identifying the literature related to BPC and extracting findings, approaches and applied conditions, consistent to the first two steps of DTN [21]. In the next stage, the extracted findings and conditions are synthesized and formulised into components. The final stage in our study follows the DTN (the last row of Table 1) by first designing a decision making process and then structuring the identified components into the decision process in order to develop a model supporting BPC. Detailed stages of our research method are presented in the following sections.

Table 1. Stages of our research method, in comparison to the SLR [20] and the DTN [21]

The current study	Structured literature review	Design theory nexus
Selecting articles	Searching for the literature	Identify different approaches in a given area
Filtering articles	Practical screen	
Data extraction & classifying articles	Data extraction	Analyse approaches to identify their applied conditions
	Quality assessment	
Data synthesis	Data synthesis	Formulate the identified conditions into assertions
A model of BPC (*Results section*)		Design a decision making process
		Develop an artifact

Selecting Articles. This stage involved the search for relevant articles addressing crowdsourcing subjects. Following a concept-centric approach that was not restricted but open to multiple sources of literature [29], we conducted keyword searches across eight popular online bibliographic databases, including ACM, EcoHost, IEEE, Emerald, Sage, ScienceDirect, Springer Link, and Wiley, between September and November 2013. The searched keywords included 'crowdsource', 'crowdsourcing', 'crowdsourced', 'crowdsourcer', and 'crowdsources'. Additional criteria for selection were that articles have been written in English and available in full text. As a result, the selecting stage identified a total of 877 articles (Table 2).

Table 2. Results of crowdsourcing searches on the eight chosen bibliographic databases

Document types	ACM	Eco Host	Em-erald	IEEE	Sage	Science Direct	Springer Link	Wiley	Total
Conference	408	-	-	170	-	-	89	-	**667**
Journal	3	6	11	47	20	53	58	12	**210**
Total	411	6	11	217	20	53	147	12	**877**

Filtering Articles. Using a screening technique [20], this stage filtered out articles that were clearly irrelevant to the focus of the current study by two following steps. We first excluded duplicates, editorial letters, posters, tutorials, work in progress (e.g. abstracts and in-brief papers). This step also eliminated conference articles that were extended and published as journal articles, in order to prevent repeated analysis. The second step restricted the pool of articles by the research question. The elimination was based on the articles' titles and keywords. Focusing on BPC, this step thus excluded articles applying crowdsourcing to medical and behaviour research, citizen science, learning, and games with a purpose. Adopting a tolerant view suggested by [30], decision to include rather than exclude was made for studies that broadly refer to BPC. As a result, a total of 536 articles remained in the initial pool.

Data Extraction and Classifying Articles. The current study, aligned with Okoli [20], developed a coding form for data extraction and used extracted data in order to classify articles. In detail, the form codified the following four dimensions for extract-

ing data and two questions for classifying articles. The first recorded dimension was general information about the article (article reference, year of publication, data of coding, and additional notes), which are typically extracted in structured literature reviews [30]. Next, our attention turned to the article's topics. Focusing on articles addressing BPC, we believed that analysing the topics of these articles helped identify the main components of BPC. In particular, we codified this dimension based on themes suggested from previous works, such as 'task design', 'task decomposition', 'workflow design' and 'incentive mechanism' proposed by [1] and [7], but still open for emerging categories as an inductive approach.

Another concerned dimension was the research findings, which reflect the different approaches and alternative solutions, necessary for developing a nexus model [21]. In addition, we considered how knowledge was generated from the findings, i.e. whether these findings can be generalised to other situations or limited to a similar context [31]. The last considered dimension codified practical implications of the articles, including recommendations, to whom these recommendations were targeted, and applied contexts.

To classify articles, the coding form consists of two questions for deciding to include articles: 'are the topics relevant to BPC?'; and 'does the article present findings supporting the establishment of BPC?'. Only articles that are both relevant and helpful for the establishment of BPC were fully codified and remained in the reviewed pool. Following Kitchenham et al. [32], the data extraction and classification were undertaken by one researcher, while the other authors randomly checked the procedure. As a result, a total of 238 articles related to the focus of the current study were reviewed in the final pool.

Data synthesis. This stage synthesized the extracted data to build a model supporting BPC. We reviewed the data extracted by the coding forms, focusing on the articles' topics, to identify components of the model. This is a four-step process. First, extracted topics were compared and aggregated to several components. We then merged together duplicate components, such as 'quality control' and 'quality estimation'. Third, we mapped sub-components into more generic components. For instance, the sub-component 'detection of gaming the system' was mapped to 'quality control'. Finally, the findings and implications of the reviewed articles were also synthesized, supporting our discussions on the model and its components.

4   Results

As a result of the previous stages, we identified 238 articles related to BPC, of which 71% are conference articles and 29% are journal articles. Regarding the years of publications, Fig. 1 shows the review articles distributed per year from 2008 to 2013. Through this figure, we note an increase on the number of studies published every year, reflecting the mature of the crowdsourcing field. It also indicates that more recently studies have provided more findings that can be generalised to other situations (the top part of the columns in Fig. 1). This leads to the plethora of recently

tested and validated findings, solutions, and approaches, which can be seen as promising materials for developing a nexus model supporting BPC.
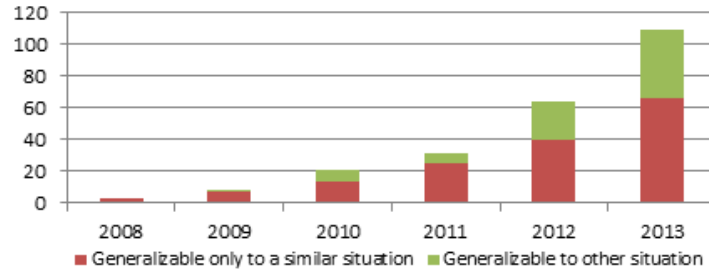
Fig. 1. Reviewed articles per year and how knowledge can be generalised form the findings

A closer look at the pool of reviewed articles reveals two groups of studies related to BPC: studies with an integrated view (29 articles) and studies addressing individual aspects (209 articles). In the first category, Table 3 summarises topics and number of articles that adopted an integrated view. From Table 3, the results are that 'deployment of crowdsourcing' is the most common topic in this category with 23 articles that focused on designing and deploying several integrated components of a crowdsourcing application. As the articles in this group [e.g. 33] described several specific components of BPC, we further analysed them for their components, and the results were combined with the analysis of the second group that address individual aspects of BPC, as presented in the next sections.

Table 3. Topics related to business process crowdsourcing with an integrated view

Main topics	No. of supporting articles
Deployment of crowdsourcing	23
Crowdsourcing framework	4
Design principles for crowdsourcing	2

4.1 Components of business process crowdsourcing

In this section, more detailed results are reported. Focusing on the components of BPC, our analysis on both integrated-view and individual-aspect articles reveals a diverse of components related to BPC. In particular, more than 20 components and sub-components were suggested by the reviewed articles. However, the number of articles supporting these components is largely different. For instance, 'guide crowdsourcing with Artificial Intelligent' was supported by only one article, whereas 'task design' was discussed by 29 articles. Following a basic assumption of crowdsourcing that groups of researchers are smarter than the smartest individual experts [34], we focused on components proposed by multiple articles.

Table 4 highlights 12 components of BPC that were supported by at least 10 reviewed articles. Within these components, quality control and incentive mechanism are the two most popular components studied in the BPC literature. As crowdsourcing

performers are voluntary members in the crowd [7, 14], it is hard for organizations to control the performance of these members. Thus, quality control mechanisms are necessary to make sure that "outcome fulfils the requirements of the requester [organization]" [35]. Also because of the voluntary nature of crowd members, incentive mechanisms are necessary to attract and motivate these members to perform the tasks [36]. To a lesser extent, these results further indicate other components of BPC, including crowd management, task design, results aggregation, workflow design, capability and characteristic of crowdsourcing, task assignment, output, platform, technical configuration, and circumstance to crowdsource and decision factors.

Table 4. Main components of business process crowdsourcing

Components of BPC	*No. of supporting articles (n>10)*
Quality control	42
Incentive mechanism	37
Crowd management	32
Task design	29
Results aggregation	26
Workflow design	25
Capability & Characteristic of crowdsourcing	23
Task assignment	21
Output	17
Platform	16
Technical configuration	16
Circumstance to crowdsource & Decision factors	16

5 A Nexus Model Supporting the Establishment of BPC

Based on the components identified in the previous section, this section aims at building a model supporting the establishment of BPC. Following the DTN method [21] that starts by designing a decision making process, we first identified the main stages related to BPC. Our analysis on the targeted audiences of the reviewed articles suggests three most important roles related to BPC, including manager (66 articles), designer (186 articles), and programmer (35 articles). Based the traditional system development life cycle [37], we transferred these roles into three stages of BPC, namely decision to crowdsource, design, and configuration. We then used these three stages to structure the identified components, which results a preliminary nexus model supporting the establishment of BPC (Fig. 2). We note that some components in Table 4 were combined together in the model. For instance, both 'capability and characteristic of crowdsourcing', and 'circumstance to crowdsource and decision factors' help organizations evaluate whether crowdsourcing is a suitable approach, and thus were combined into the 'decision to crowdsource'. 'Technical configuration' and 'platform' were also merged because crowdsourcing configuration should be examined on a particular platform. Besides, 'task decompositions' was integrated to 'work-

flow design', while 'task assignment' was combined with 'crowd management'. The detailed model is discussed below.
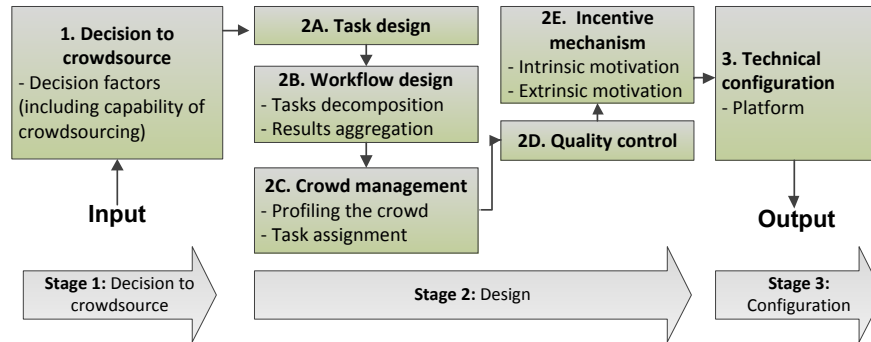

Fig. 2 A preliminary nexus model supporting the establishment of BPC

Decision to crowdsource. According to the reviewed articles [38, 39], *the decision to crowdsource* is positioned in the first phase of the crowdsourcing activity. Therefore, it is presented as the initial component in our model (component 1). Using *the input*, this component initially conceptualizes the crowdsourcing application in order to "decide whether the crowdsourcing approach is appropriate to solve their internal problem/problems [tasks]" (p. 322) [38]. Examining this component, our previous study has already identified and analysed several factors influencing the decision to crowdsource [40]. That study classified and structured the identified factors into a decision framework, considering task, people, management, and environmental factors. Based on the framework, the study [40] proposed a series of decision tables with actionable guidelines for making a crowdsourcing decision.

Design. After an organization decides to crowdsource, the design stage transfers the conceptual information determined by the decision factors into concrete design. In this stage, *task design* is important in the crowdsourcing activity, and thus was proposed as the second component in the model (component 2A). Both Malone et al. [41] and Rosen [42] suggest clearly defining what tasks are crowdsourced. Similarly, most studies in our review that deployed a crowdsourcing application have focused on designing tasks as a crucial part of their deployment [33, 43]. To design crowdsourcing tasks, the task properties suggested by [44] can be used as a starting point.

The next component, *designing workflow*, "facilitate[s] decomposing tasks into subtasks, managing the dependencies between subtasks, and assembling the results" [1]. Adopting this definition, we integrated 'task decomposition' and 'results aggregation' as two sub-components of 'workflow design' (component 2B). The role of this component has been highlighted by several researchers, who do not examine individual tasks but the whole crowdsourcing workflow [1, 27]. Organizations can choose different actors to design workflow, including the organization [25], the crowd [45], or a combination between the crowd and the organization [27].

Crowd management is the component that refers to how organizations manage members in the crowd to achieve defined tasks (component 2C). Addressing this component, the literature suggests two sub-components: profiling the crowd [46, 47] and assigning tasks according to profiles [48]. In profiling the crowd, organizations need to evaluate the completeness and effectiveness of crowd members when performing tasks [1, 47], and use this evaluation to build the member profiles. Based on these profiles, different mechanisms can be devised to assign tasks to suitable members, such as the auction-based mechanism [13] and scheduled mechanism [48].

According to Table 4, *quality control* (component 2D) is the most popular component addressed by the reviewed articles, which implies its important role in BPC. The fact that crowdsourcing workers have diverse background and knowledge [14] and work voluntarily may lead to poor results. Thus, quality control is necessary. Agreeing on the necessity of this component, Naroditskiy et al. [49] extend this component by includeing functions for preventing malicious behaviours from the crowd members. In the reviewed literature, several quality control mechanisms were proposed, which can be generally grouped into two approaches: design-time and runtime [35]. At design time, organizations can design tasks in a robust way for reducing malicious behaviours, like several mechanisms proposed by [50]. At run-time, organizations can choose three mechanisms for controlling crowdsourcing quality, using the crowd, using experts, and relying on third-party organizations [7].

Organizations, which aim to successfully design a crowdsourcing application, need to attract and engage the crowd members. This attraction can be done through *incentive mechanisms* (component 2E). Borrowing from psychology that two main types of motivation are intrinsic and extrinsic ones [51], incentive mechanisms in BPC should influence different factors of the intrinsic and (or) extrinsic motivation. For extrinsic motivation, most of the reviewed articles examine the usage of financial incentives [26, 36]. For intrinsic motivation, several other factors were suggested, such as love of the community [26] and help other people through meaningful tasks [52].

Configuration. The final component focuses on how to *configure* crowdsourcing in a certain platform (component 3). In general, organizations can choose to develop or use an existing platform. However, with the availability of several crowdsourcing platforms, where a large number of members exist, the choice of utilising available platforms seems to be more attractive, and was supported by several studies [53, 54]. Given that, we suggest configuring crowdsourcing applications on a chosen platform, rather than developing a new platform. Another reason for choosing an existing platform is that the current literature has proposed several tools supporting the configuration, such as Turkit [55] and Crowdforge [45]. As a result, this component returns an *output* of the process, which includes an installation of the crowdsourcing application and the accomplished tasks that were crowdsourced.

6   Conclusion and Future Work

Addressing the lack of a way to establish crowdsourcing as an organizational business process [9-11, 56], this study proposed a preliminary nexus model supporting the

establishment of BPC. We identified and synthesized several important components of BPC. We then chose 12 components that were suggested by at least 10 reviewed articles and integrated them into a model supporting the establishment of BPC. From the 'wisdom of the researchers' where the collective researchers are smarter than the few [34], it can be stated that our model and its components capture the main business processes of crowdsourcing as they were supported by multiple articles. As a result, the current study has provided important implications for both academics and practitioners.

From the academics' perspective, our study adopted a broad view of what the literature has reported on BPC, overcoming the ad-hoc issues in the crowdsourcing literature [15, 16]. As a result, the study provides a good starting point for academics from both the crowdsourcing field and other disciplines that aim to follow up the components or model discussed in this work. For instance, researchers from computer security, who may use crowdsourcing for collecting and processing malware datasets, can use our model for building the corresponding business process.

Methodologically, the current study validates the design science method proposed by Pries-Heje and Baskerville [21] when applying it to the context of crowdsourcing. Additionally, we extend this method by combining it with a SLR [20] that systematically identifies existing approaches and components in the crowdsourcing literature, which is a key requirement for this design science method [21]. From another methodological aspect of IS literature review, our study is one of the most comprehensive reviews in the crowdsourcing field, in terms of number of reviewed articles. We analysed 238 articles, compared to 55 articles in a review by Zhao and Zhu [7]. Consequently, our review contributes to establish background for the emerging of crowdsourcing field [29].

From the practical view, our study provides insights for organisations to employ business processes based on crowdsourcing. In particular, our model has seven sequent components that were structured corresponding to three stages: the decision to crowdsource, design, and configuration, which can be used to guide how to plan, analyse, design, and configure BPC. Based on this model, we also provided discussions and implications about approaches and solutions in each component, contributing to organise case evidences that are currently unarranged in the crowdsourcing practices [57].

As future work, an interesting direction is research on transferring the model into a tool supporting BPC. This requires detailed rules or assertions that can be directly applied to the decision making process [21]. Thus, we plan to extend our preliminary model by further analysing the reviewed articles. In fact, a part of this analysis was conducted by our previous work [40], where we analysed the decision to crowdsource and proposed a series of decision tables for making crowdsourcing decision. Another future direction includes explicit formalizing concepts related to BPC and exploring relationship between these concepts, which can be based on the components of our proposed model. This direction can lead to an ontology enriching the understanding on BPC and providing a mean for sharing knowledge in the domain.

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