

# A Bibliometric Review of Research on Crowdsourcing Bidding Decision-Making 2011-2022 in Malaysia

**Ahmad Syahmi Ahmad Fadzil\***

Faculty of Business and Management, Universiti Teknologi MARA  
Email: syahmifadzil@uitm.edu.my

**Nor Azairiah Fatimah Othman**

Faculty of Business and Management, Universiti Teknologi MARA

**Luqmanul Hakim Johari**

Faculty of Business and Management, Universiti Teknologi MARA

**Ramayah Thurasamy**

Graduate School of Management, Universiti Sains Malaysia

**Gouri Domini Jacob**

Faculty of Business and Management, Universiti Teknologi MARA

**Sharidatul Akma Abu Seman**

Faculty of Business and Management, Universiti Teknologi MARA

*\*Corresponding Author*

## **Abstract**

**Purpose:** Crowdsourcing is a vital component of Malaysia's digital economy, contributing substantially to the country's GDP and employment. It plays a significant role in Malaysia's digital economy, contributing 22.6% to the country's GDP in 2020 and employing 7.7% of the population. This study examines the aspects of scientific literature including publications, authors, journals, and citation patterns to gain better understanding of the field.

**Design:** To gain insights into crowdsourcing decision-making, a bibliometric analysis was conducted using data from the Scopus database. Scopus was chosen due to its extensive collection of academic publications and frequent updates.

**Findings:** The analysis revealed limitations in terms of the topical scope and sources of documents. The research on crowdsourcing decision-making is still relatively scarce, as evidenced by the existence of only 23 relevant documents. The research on crowdsourcing decision-making remains limited, emphasizing the importance of future studies in this area especially to Malaysia in capitalizing the digital economy.

**Research Limitations:** This bibliometric analysis focuses primarily on published scientific literature, which may not capture all forms of research output. It may overlook other valuable contributions such as patents, technical reports, conference papers, and unpublished research.

**Practical Implications:** This scarcity highlights the need for further studies to explore and expand our understanding of crowdsourcing decision-making theoretically and practically. This study has shed light on the paucity of research on crowdsourcing bidding decision-making on a global scale. Nonetheless, the study of this topic will greatly benefit Malaysia on capitalizing its digital economy forefront.

**Originality:** This review has the quality of being new the extent to none of former reviews had detailed the statistical analyses on topic of Crowdsourcing Bidding Decision-Making in Malaysia. In addition, they were merely 23 total publications on crowdsourcing bidding decision making worldwide to date. Many scholarly works on crowdsourcing are focusing on crowdsourcing platforms, social networking (online), internet and social media related studies.

**Keywords:** Crowdsourcing, Bidding Decision-making, Bibliometric Analysis, Malaysia, MDEC

### 1.0 Introduction

Crowdsourcing in Malaysia is one of the digital economy's pillars, contributing 22.6% of the Malaysian GDP in 2020. This sector also contributes 7.7% of total employment in Malaysia (The Malaysian Reserve, 2021). Malaysian Digital Economy (MDEC) is the governing body that controls and initiates programs to sustain Malaysian crowdsourcing activity. It was established in 1996 as the lead agency to implement the MSC Malaysia initiative. Recently, MDEC conducted two eRezeki Global Online Workforce (GLOW) programs to help Malaysian people get jobs and generate income through a crowdsourcing platform. eRezeki allows users, especially those from low-income backgrounds, to earn money by completing digital tasks for businesses through an online crowdsourcing platform (Janom et al., 2020). In eRezeki, people's abilities are evaluated, and their digital job is assigned accordingly. By 2020, this platform would have generated RM1.3 billion in income and attracted 700,000 participants in Malaysia.

The origins of crowdsourcing can be traced back to 1714 when the British government offered crowd rewards to those who discovered a method for determining a ship's longitude at sea. Modern crowdsourcing is defined as "transferring jobs within an internal organisation to a large crowd of crowd workers through an open call" (Howe, 2009). The term "crowdsourcing" refers to a method of organising labour in which businesses assign tasks to a large group of people, typically those with access to the Internet, and pay anyone in the "crowd" who completes the assignment. Companies have used crowdsourcing by advertising job openings on their websites. According to the research conducted by Prpic' (2015), crowdsourcing can be used as a tool that uses information technology for business purposes. Crowdsourcing is a concept that consists of 3 key components (Janom et al., 2020);

1. Job provider- A party that provides jobs in a crowdsourcing platform.
2. Platform – A web platform that acts as a third party to allow the job providers to access the crowd.
3. Digital worker – A person or group of people that bid and work on crowdsourcing tasks.

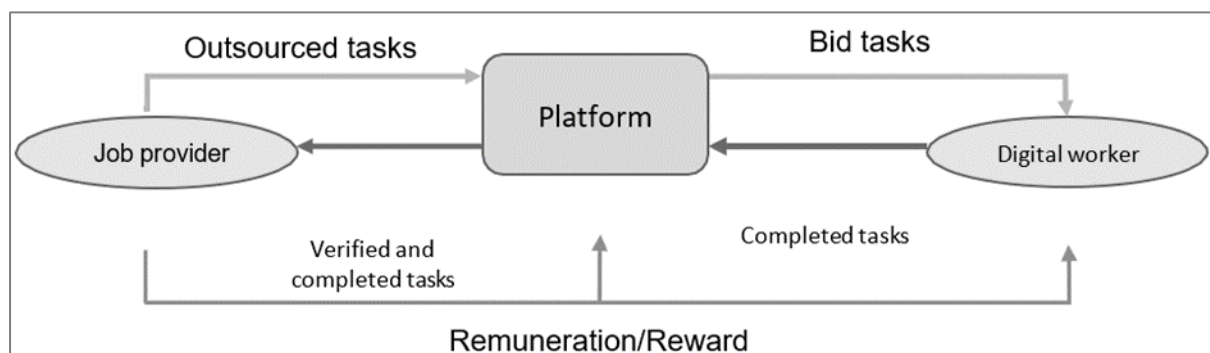


Figure 1: Crowdsourcing Business Model

The general term “bidding decision-making refers” to the procedure involved in the bidding

process. The bidding procedure process included deciding whether to make a bidding decision. Furthermore, only a few bidding decision models were developed by past researchers (Akalp, 2016). In crowdsourcing, "bidding decision" refers to the process through which digital workers submit bids to job providers to secure a project. The bidding process is when a digital worker bids on a project offered by a job provider on a crowdsourcing platform to assist them in achieving their primary goals and objectives (Xu, 2021).

Bidding decisions are based on many fields of study, such as psychology and communication. So, one thing that can be said about decision-making based on research done in the past is that most academics see it as a logical process with several steps (Hung, 2012). The bidding decision process is essential for digital workers to enhance their skills to propose a job bid.

Also, using the bidding decision process increased the chances that digital workers would win a bid and get the best result from bidding (Trabelsi, 2022). Job bid decision-making is the process of making the optimal decision based on the availability of bid information. It includes how digital workers gain optimal benefits, such as rewards, by bidding on the best job they have chosen (Slivskins, 2013).

Nevertheless, despite the growth and expansion of crowdsourcing implementation in recent years, bibliometric analysis regarding crowdsourcing decision-making is still scarce and low in volume. Past bibliometric analyses only examined general crowdsourcing (Malik et al., 2019), crowdsourcing bibliometrics in smart cities (Jiang et al., 2022), and crowdsourcing in the field of public health (Wang et al., 2019). Therefore, it creates an awareness for researchers to conduct a bibliometric analysis of decision-making in crowdsourcing. Past literature indicated that decision-making might be influenced and built based on a few theories and models, such as Herzberg two factor theory and the Motivation incentives activation model (MIAB) (Wang et al., 2019) sizes or line spacing to squeeze more text into a limited number of pages. Use italics for emphasis; do not underline. No spacing between paragraphs.

## 2.0 Methodology

### 2.1 Research Objectives

This analysis intends to observe and examine crowdsourcing decision-making based on bibliometric analysis. This bibliometric review addressed the following research objectives.

1. The trend of publications regarding crowdsourcing decision-making in the past 10 years.
2. The country that publishes most research about crowdsourcing decision-making.
3. The top keyword relates to bidding decision-making in crowdsourcing.
4. Top subject area that researched bidding decision-making in crowdsourcing.

### 2.2 Method Analysis

The methodological analysis implemented to conduct this research is depicted in Table 1.

Table 1: List of methodological analysis

Method of analysis	Sources
Focus of the study	Crowdsourcing decision-making
Database sources	Scopus database
Timeframe	2011-2022
Methodology analysis	Bibliometric analysis
Tool implements in analysis	VOSviewer- to develop and visualize bibliometric networks. Harzing's Publish and Perish- to compute the citations metrics.

### 2.3 Data Analysis

The data analysis implemented to conduct this research is depicted in Figure 2: Bibliometric search flow diagram.

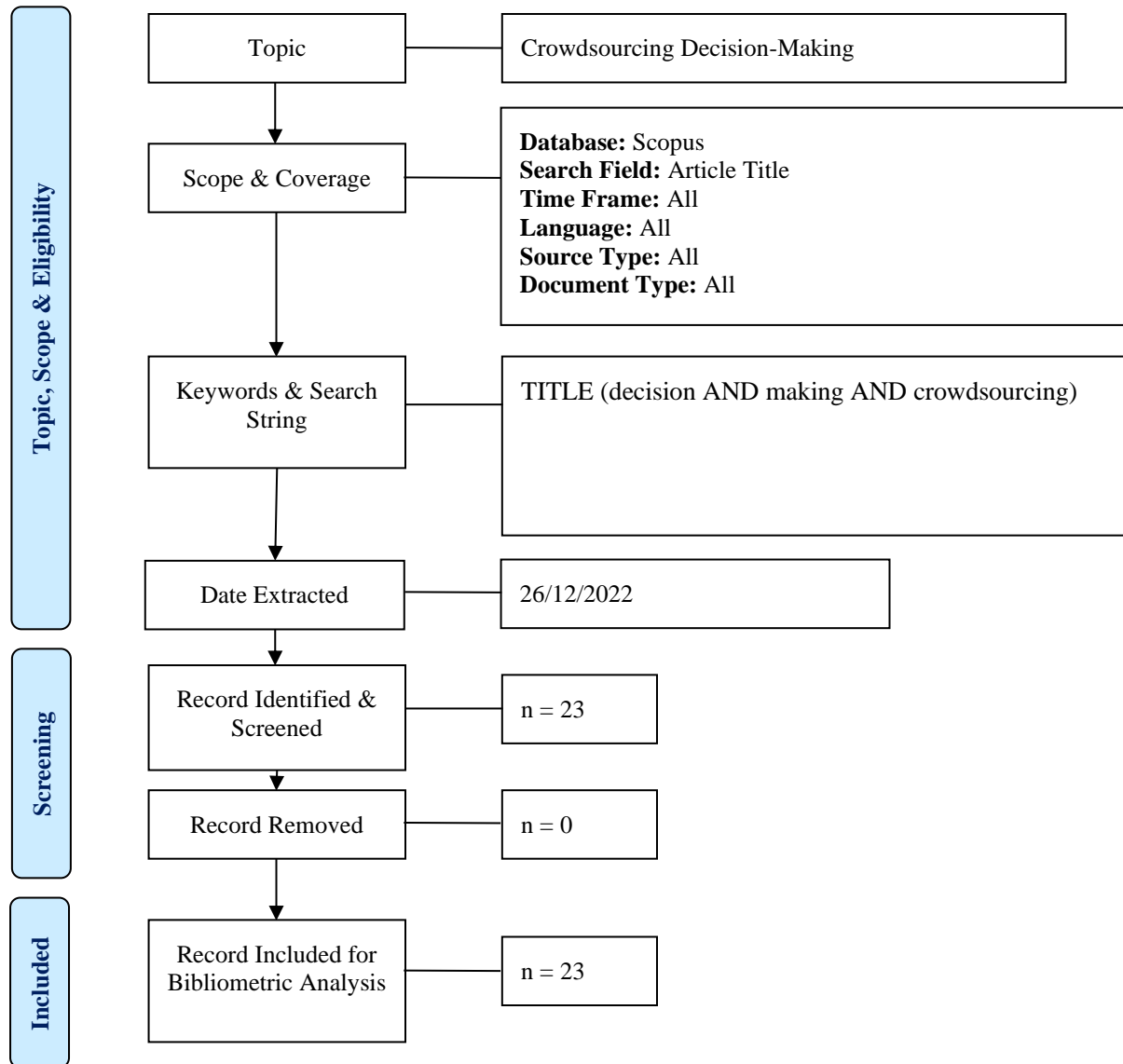


Figure 2 : Bibliometric search flow diagram (Sources: Scopus database)

The term "bibliometrics," according to Pritchard (1969), is "the application of mathematics and statistical methods to read materials and other sorts of communication." The term implies that bibliometric analysis measures the properties of books (or, in this study's case, a literature collection) using bibliographic data. A bibliometric analysis is becoming more popular as one of the methods for revealing the trend and patterns of studies (Ahmi & Mohamad, 2019). The patterns of the studies can be seen by categorising publications by year, author, affiliation, or country. The publication's impact and performance can also be measured using matrices such as the number of citations, citations per year, h index, and g index. Furthermore, the state of the art of publications can be mapped and visualised using various indicators such as co-authorship, co-citation, keyword or term occurrences, and bibliographic coupling.

On December 26, 2022, data were retrieved from the Scopus database. Scopus was chosen because, compared to other databases like Web of Science and Google Scholar, it is one of

the largest abstract and citation databases of academic publications that can be searched and is constantly added to and updated (Rew, 2010; Wahid et al., 2020). Furthermore, the Scopus database is reliable compared to other sources. The search method for this bibliometric analysis was refined to only the article title, which is crowdsourcing decision-making. Other fields, such as abstract and keyword, were excluded from this search method. The search is narrowed down from 2011 to 2022 to find the most recent trend in crowdsourcing bidding decisions.

### 3.0 Results

#### 3.1 Trend Publication

From 2020 to 2022, the number of publications in the Scopus Database about bidding decisions in crowdsourcing went down. The highest number of publications was recorded at only 3 publications in 2013, 2014, 2015, and 2020. Finally, publications about decision-making in crowdsourcing still have few publications. This data also indicated that the number of publications about decision-making through crowdsourcing is still low in volume. This is because the highest number of publications per year only managed to publish 3 publications related to the study of crowdsourcing decision-making.

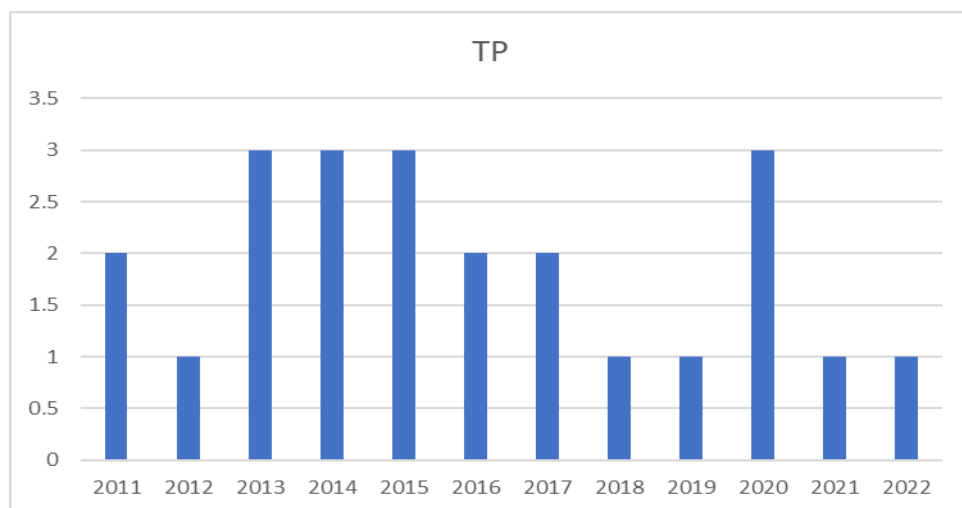


Figure 3: Number of publications by year (Source: Scopus database)

#### 3.2 Total Publication based on Document Type

The data recorded from the Scopus database indicated that conference papers are the most common type of document that publishes titles about crowdsourcing decision-making. The conference paper recorded 12 publications, followed by an article with 10 publications, and the book recorded only 1 publication. In conclusion, it can be concluded that most publications regarding crowdsourcing decision-making in the past ten years have been published as conference papers.

The Scopus database showed that conference papers are the most common place where titles about bidding decisions in crowdsourcing are published. The conference paper was published 12 times, the article 10 times, and the book was only published once. In conclusion, it can be concluded that most publications regarding crowdsourcing decision-making in the past ten years have been published as conference papers.

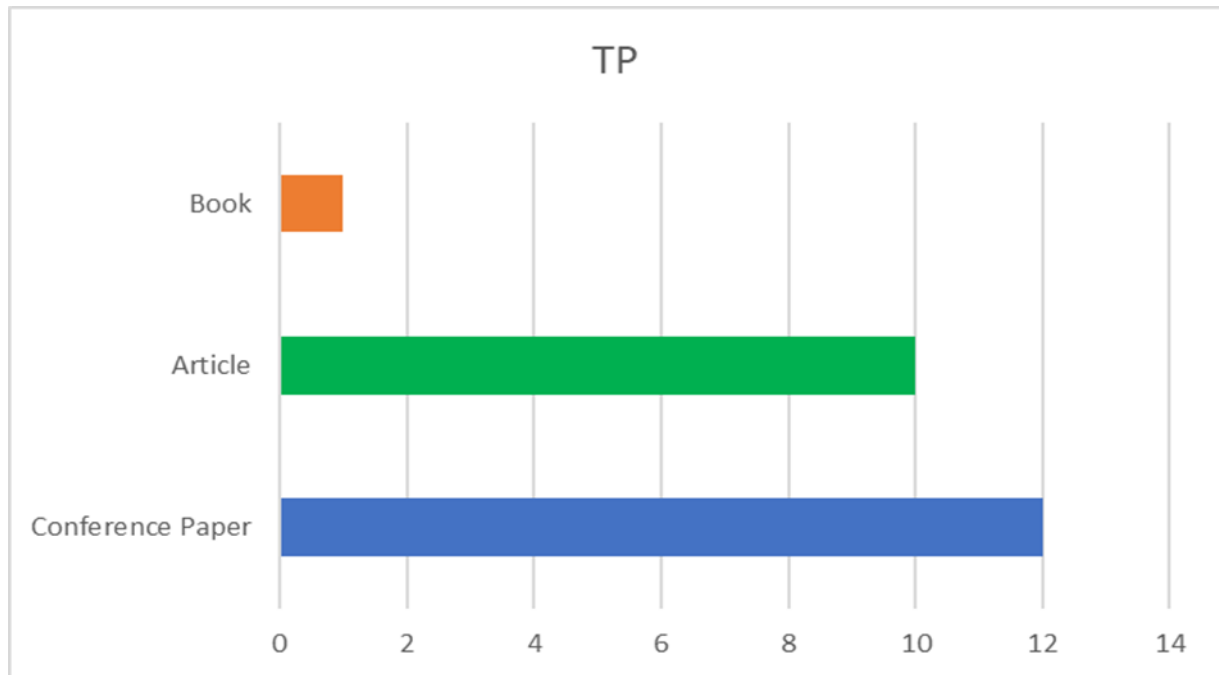


Figure 4: Number of Publications based on Document Type.

### 3.3 Total Publication based on Subject Area

Based on the information in the Scopus database, computer science is the field that writes the most about bidding decisions in crowdsourcing. Computer sciences recorded 19 publications, followed by engineering with seven publications. Business, Management, and Accounting recorded only five publications. Only three publications were made in the fields of Decision Sciences, Mathematics, and Social Sciences. Thus, it can be concluded that for the past ten years, the computer sciences faculty has been the faculty that has published the most publications about crowdsourcing decision-making. The data recorded from the Scopus database indicated that conference papers are the most common type of document.

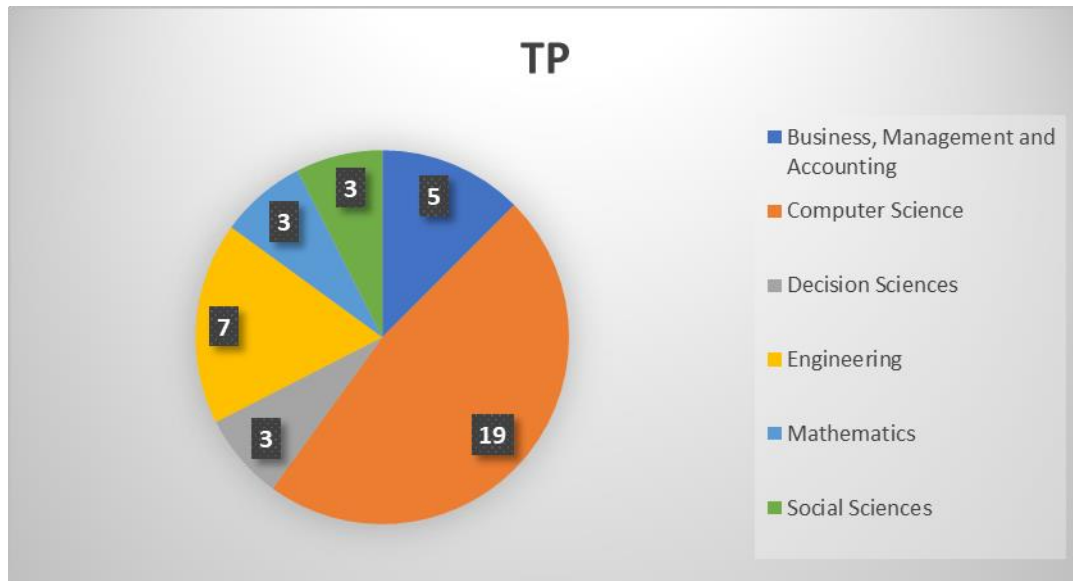


Figure 5: Number of Publication based on Subject Area

### 3.4 Top Countries Contributed to the Publications

The data from the Scopus Database indicated that China and the United States contribute to most of the publications about crowdsourcing decision-making, with seven publications each. Algeria, Germany, and Singapore all followed it, each with two publications. The remaining countries that only manage one publication include Brazil, Hong Kong, Iran, Japan, Poland, Portugal, Romania, the Russian Federation, South Africa, South Korea, and Uganda. This data also indicates that Malaysia has not published research about crowdsourcing decision-making.

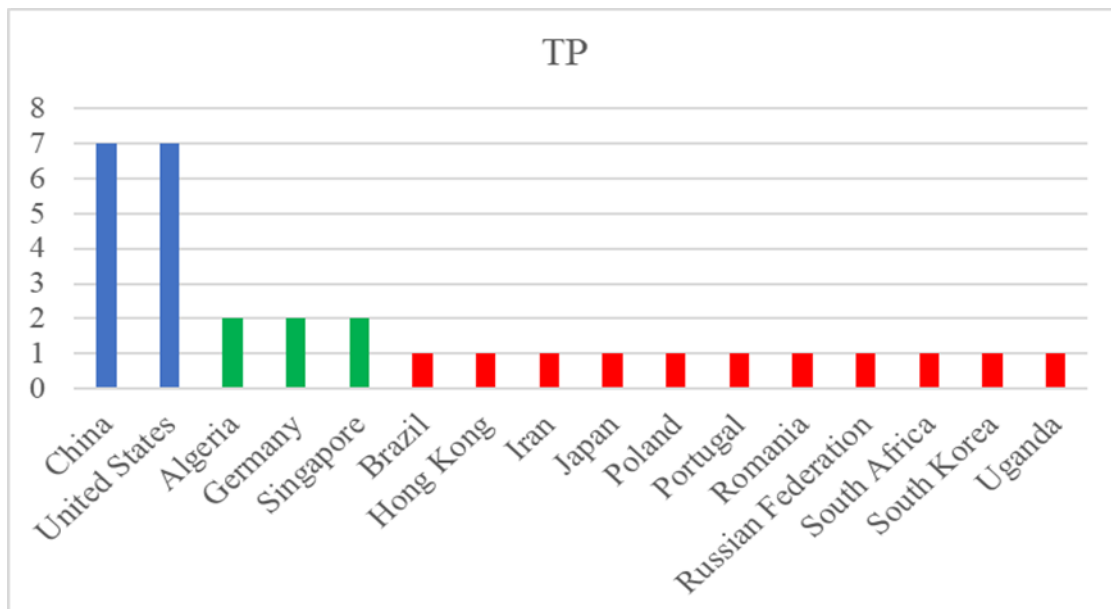


Figure 6: Total Number of Publications among Countries



### 3.5 Keyword Analysis

The keyword analysis indicated that the top 3 keywords for crowdsourcing decision-making were decision-making, crowdsourcing, and behavioural research. Thus, this data indicated that, apart from crowdsourcing decision-making, behavioural research contributed to the most keywords in this publication. Therefore, it explains that crowdsourcing decision-making is related to the study of behavioural research.

Table 2: Top Authors' Keywords

Author Keywords	Total (TP)	Publications Percentage (%)
Decision Making	20	86.96
Crowdsourcing	19	82.61
Behavioural Research	6	26.09

The keyword co-occurrence analysis is created by treating each keyword as a node and each co-occurrence of a pair of words as a link. The frequency with which two words co-occur determines the strength of the link between these two keywords. This construction results in a weighted network (Radhakrishnan et al., 2017). Visualizing the network actors and links, which are based on publication data and the co-occurrence of keywords, makes it possible to map the dynamic evolution of knowledge. Moreover, network properties of networks created in this study can be calculated to derive a quantitative analysis of knowledge evolution (Su & Lee, 2010).

In this analysis, decision-making stated the highest occurrence with 20 occurrences and recorded 25 link strengths. This was followed by crowdsourcing with 19 occurrences and 24 total link strengths. Lastly, behavioural research recorded 6 occurrences with 11 total link strengths.

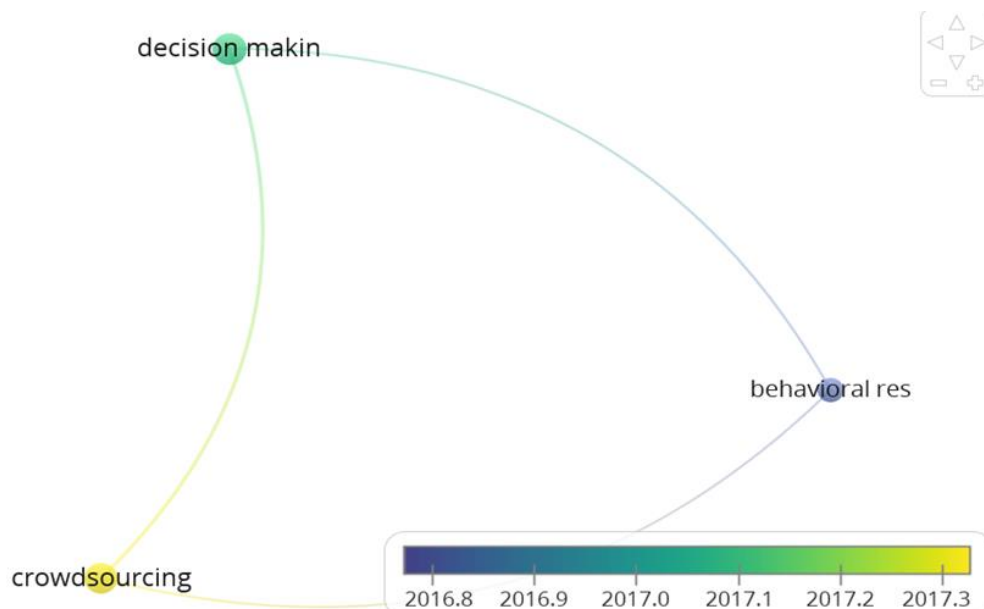


Figure 7: Keyword Co-occurrence analysis (Sources: VOS VIEWER)

### 3.6 Co-authorship Analysis

Co-authorship analysis in science and technology (S&T) collaborations reveals collaboration patterns between individuals and organisations. Co-authorship of a technical paper is an



official declaration of participation by two or more authors or organisations. Despite the controversy surrounding its meaning and interpretation, co-authorship analysis is still commonly employed to comprehend and evaluate scientific collaboration patterns. In co-authorship networks, nodes represent writers, organisations, or countries that are linked when they co-authored an article (Fonseca et al., 2016)

The relationships show the number of co-authorship links between a researcher and other scholars' attributes. The Total Link Strength feature displays the total strength of the co-authorship ties of a particular researcher with other researchers. Figure 8 above exhibits the data that Vos Viewer filtered. Based on this analysis, only 2 authors with authorship link strength, Simões et al. (2017) and Raimundo et al. (2017), contributed to 1 co-authorship link strength. Both authors contributed to 3 citations in crowdsourcing decision-making analysis.



Figure 8: Co-authorship Network Visualisation

### 3.7 Co-authorship Countries Network

The co-authorship countries network for publishing on crowdsourcing decision-making resulted in 3 countries: China, Singapore, and the United States. China recorded 7 documents with 93 citations and 3 link strengths. This was followed by Singapore, which recorded 2 documents with 82 citations and 2 link strengths. Lastly, the United States recorded 7 documents with 83 citations and 1 link strength.

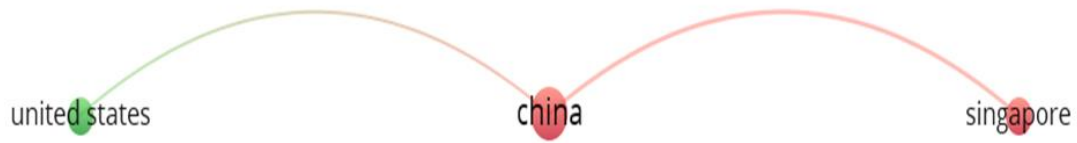


Figure 9: Cooperation network among countries in crowdsourcing decision-making

### 3.8 Citations Metrics

Citation metrics are based on the number of times a work is cited as an indicator of the quality of the work: the more citations, potentially, the more significant the impact. Citation data is available from citation databases, discipline-specific databases, and through an emerging range of alternative metrics (Ma, 2021). A citation occurs when one paper explicitly refers to another paper, and the complete reference or cited paper is included in the bibliography of the citing paper. The h-index quantifies the scientific research output of an individual. The h-index is calculated using a researcher's most cited papers and the number of times those papers have been cited by other authors. In calculating the h-index, an effort is made to measure a scientist's scientific output and apparent scientific influence (Dhamdere, 2017).

Table 3: Citations Metrics

Metrics	Data
Papers	23
Citations	192
Years	12
Cites Year	16.08
Cites Paper	8.39
Cites Author	80.67
Papers Author	10.26
Authors Paper	3.09
h_index	6
g_index	13

Based on the citation metrics indicated, this publication has 23 papers and 192 citations. The citation year number is 16, while the citation paper is 8.35. The cited paper is 80.42, while the paper's author is 10.26. Lastly, the h index is 6, while the g index is 13.

### 3.9 Highly Cited Documents

The table above indicates the 10 most highly cited articles in crowdsourcing decision-making. The most cited article is “An online cost sensitive decision-making method in crowdsourcing

systems” by Gao et al. (2013). This article recorded a total of 45 citations or 4.5 citations per year. This was followed by the article “A reputation-aware decision-making approach for improving the efficiency of crowdsourcing systems,” written by Yu et al. (2013), which recorded 36 citations and 3.6 citations per year. Next, the following articles that recorded more than 10 citations are “Decision making in a Web 2.0 environment: Crowdsourcing lessons for organizations”, “Stochastic Decision Making for Adaptive Crowdsourcing in Medical Big-Data Platforms,” and “Good to Be Novel? Understanding How Idea Feasibility Affects Idea Adoption Decision-Making in Crowdsourcing

Table 4: Top 10 Highly Cited Articles

No.	Author(s)	Title	Total Citation	Citation per year
1	Gao et al. (2013)	An online cost sensitive decision-making method in crowdsourcing systems	45	4.5
2	Yu et al. (2013)	A reputation-aware decision-making approach for improving the efficiency of crowdsourcing systems	36	3.6
3	Rosen and Peter (2011)	Decision making in a Web 2.0 environment: Crowdsourcing lessons for organizations	29	2.42
4	Kim and Lee (2015)	Stochastic Decision Making for Adaptive Crowdsourcing in Medical Big-Data Platforms	27	3.38
5	Chan et al. (2018)	Good to Be Novel? Understanding How Idea Feasibility Affects Idea Adoption Decision Making in Crowdsourcing	19	3.8
6	Moradi et al. (2016)	Learning decision making for Soccer Robots: A crowdsourcing-based approach	7	1
7	Ochara et al. (2012)	Groupthink decision making deficiency in the requirements engineering process: Towards a crowdsourcing model	4	0.36
8	Ciurea et al. (2019)	Consensus versus Crowdsourcing in Collaborative Decision-Making Applied in Cultural Institutions	3	0.75
9	Li et al. (2019)	Optimization of order-driven production decision making in crowdsourcing supply chain with omnichannel design	3	0.75
10	Simões et.al. (2017)	Supporting decision making during emergencies through information visualization of crowdsourcing emergency data	3	0.5

#### 4.0 Findings (Heading 1 Arial 12 Bold)

##### 4.1 Limitations of the review

The topical scope and source of documents are the primary limitations of this review. The research that was conducted on decision-making is still scarce. The existence of only 23 documents explains that the research related to crowdsourcing decision-making is still scarce and low in volume. Therefore, there is a great need of future study to be conducted to explore

more on crowdsourcing decision-making.

Next, another limitation is that this review focused on the topic of "crowdsourcing decision-making" only. At times, the breadth of this subject resulted in ambiguity in the application of inclusion and exclusion criteria during the review's search phase, which narrowed the output results. Thus, this led to a narrow and low volume of findings.

Then, the third limitation stems from our reliance on the Scopus index as a source of documents. While Scopus provides more comprehensive coverage than the Web of Science (Mongeon & Paul-Hus, 2016), it provides slightly less comprehensive coverage of books, conference papers, and journal articles. This limitation was mitigated using author co-citation analysis to capture additional relevant literature referenced by documents in our review database.

The fourth limitation is the interpretation of criteria, measurement, and quality of the document chosen as a publication. Although Scopus is considered a reliable database, it does not explain on what basis a specific document was accepted as a publication document. For example, in this crowdsourcing decision-making publication, the Scopus database finds 23 documents related to the title research. Scopus needs to explain on what basis and by what measurement the list of 23 publications had been accepted as reliable publications, which led to the suspension of quality measurement.

#### 4.2 Interpretation of the results

This bibliometric review identified a total of 23 Scopus publication findings. Between 2011 and 2022, the results indicated that the trend of publications related to crowdsourcing decision-making is still scarce and needs to be discovered. These results also stated that there would be a need to emphasize conducting more research related to crowdsourcing decision-making. Furthermore, based on the keyword, it indicated that crowdsourcing decision-making is a subject related to behavioural research.

### 5.0 Conclusion and Recommendations

The results of the bibliometric analysis evidently illustrated the paucity of the research in Malaysia and the global perspective. Additionally, it also uncovered the downward trend in crowdsourcing decision-making which indirectly represents the scarcity number of publications regarding crowdsourcing decision-making globally. Therefore, it is essential for researchers to conduct more research regarding crowdsourcing decision-making in the future by diversifying the research topics, encourage interdisciplinary collaborations, sharing of findings and insights to facilitate the exchange of ideas among researcher and practitioners and conducting more empirical studies on a global scale. While this bibliometric analysis has shed valuable insights, future research should also focus on conducting empirical studies to validate and expand upon the findings. Experimental studies, surveys, case studies, and interviews can provide a deeper understanding of the content analysis on the job provider, the platform, and the digital worker. Additionally, uncovering the limitations of theories on the decision-making processes in crowdsourcing may posit a good reference to further reinforce this area of study. Ultimately, further research could offer better knowledge and practical implications for businesses and organizations.

Looking on the Malaysia context, more effort should be made in gaining better momentum on capitalizing the crowdsourcing, decision-making and the digital economy. Implementing the said future research recommendations can benefit MDEC by providing the institution with enhanced knowledge, evidence-based decision-making, strengthened partnerships, improved policy and program development, and establishing them as a thought leader in the field. These benefits can significantly contribute to the growth, innovation, and sustainability of the digital

economy in Malaysia. Despite crowdsourcing business model being great at leveraging collective intelligence and skills, the digital capability yet remains as the necessary condition for digital business model innovation (Ming et al., 2022). Overall, the bigger encumbrance of the scope should be prioritized. The crowdsourcing digital economy is of great importance to Malaysia as it drives economic growth, employment, innovation, and competitiveness. Recognizing its significance, Malaysia has been actively fostering an environment conducive to digital transformation and has positioned itself as a regional digital hub in Southeast Asia.

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