

# Analysis of Motivational Theories in Crowdsourcing Using Long Tail Theory: A Systematic Literature Review

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## ABSTRACT

Motivational theories have been extensively studied in a wide range of fields, such as medical sciences, business, management, physiology, sociology, and particularly in the natural sciences. These theories are regarded as crucial in motivating online workers to engage in crowdsourcing. Nevertheless, there is a dearth of research on an overarching review of these theories. We performed a systematic literature review of peer-reviewed published studies focusing on motivational theories to identify popular theories and risks associated with nascent theories presented over the last decade in crowdsourcing. Based on a review of 91 papers from the domain of the natural sciences, we identified 35 motivational theories. The long tail theory helped us to identify the contribution of major influencing theories in a crowdsourcing environment. The results justify the long tail theory based on the Pareto principle of 80/20, which underlines the 20% of the popular motivation theories, namely self-determination, expectancy-value, game, gamification, behavior change, and incentive theory, as a cause of 80%. Similarly, we discussed the risks associated with 10 theories presented over the long tail, which have a frequency equal to 2. Understanding the significant impact, approximately 80%, of widely recognized motivational theories and their role in risk identification is crucial. This understanding can assist researchers in optimizing their results by effectively integrating these theories.

## KEYWORDS

motivational theories; long tail theory; crowd engagement; crowdsourcing; systematic literature review

Motivation plays a vital role in enabling individuals to undertake diverse tasks and achieve goals<sup>[1]</sup>. It is a topic of multidisciplinary research that has been extensively explored in various fields, including business and management<sup>[1]</sup>, psychology<sup>[2]</sup>, medicine<sup>[3]</sup>, and social sciences<sup>[4]</sup>, among others. Motivation is viewed as the impetus that drives individuals to engage in an action that may be objective, related to a specific goal, or subjective, originating in the mind<sup>[5]</sup>. It allows one to experience desires and aversion<sup>[6]</sup>, and motivation can be sharpened in a way that would positively motivate the crowd and result in enjoyment, entertainment, and fun<sup>[7]</sup>.

Over the course of the past century, various motivational theories have been developed by researchers who studied human physiology to establish the realities of motivation. The Self-Determination Theory (SDT) was created by Ryan and Deci<sup>[8]</sup>, the Expectancy-Value Theory (EVT) was developed by Wigfield and Eccles<sup>[9]</sup>, and the game theory was created by Neumann and Morgenstern<sup>[10]</sup> among the most prominent. Motivational theories have demonstrated their worth and effectiveness over time and are viewed as promising models of motivation. The effectiveness of these theories is determined by the kind of motivational features they provide, and researchers can assess and evaluate for their value in various campaigns.

Motivational theories have been a topic of great interest to researchers across various fields since their inception and demonstrated efficacy. These theories have proven effective in diverse practices such as industrial management to encourage productivity and efficiency, research to garner feedback from a broader group, and building a sense of community and active

participation in society. Recently, validated and successful motivational theories have gained significant popularity among researchers in natural sciences.

The rise of the Information Technology (IT) age has highlighted the importance of creating new platforms for mass engagement, where integrating online methodologies with IT can prove to be efficient and effective<sup>[11]</sup>. One such successful platform is known as CrowdSourcing (CS), which was first coined by Howe<sup>[12]</sup> in 2006. Crowdsourcing refers to leveraging the power of the masses to achieve tasks that were once limited to a select few. Through online platforms, crowdsourcing has enabled researchers and industries to receive feedback and push tasks based on an individual's demographics<sup>[13]</sup>. The individuals who engage with these platforms to perform tasks are known as a crowd or a solver.

Crowdsourcing can take several forms, with online platforms being recommended for their diversity of participants, experiences, and expertise. Motivation has different interpretations depending on the context, and its integration into crowdsourcing has proven highly effective<sup>[14]</sup>. The definition of crowdsourcing used in this paper is based on Brabham's formulation, which characterizes it as "a model of distributed problem-solving and production that takes advantage of the collective intelligence of online communities to serve the goals of a specific crowd and organization"<sup>[15]</sup>.

The success of crowdsourcing largely depends on the motivation of the participants or "workers" who engage with the platform to perform tasks. To keep the workers engaged, researchers have adapted various motivational theories with internal, external, or both types of motivational features on online

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platforms. These motivational theories are based on sets of features that are designed to enforce motivation when implemented. One such theory is the self-determination theory, which has been widely accepted as an effective way to motivate individuals by providing them with three basic needs, competence, autonomy, and relatedness. According to Ryan and Deci<sup>[6]</sup>, these three basic needs are essential to keeping individuals motivated and engaged in a task, namely competence, autonomy, and relatedness. While game theory is a branch of mathematics and economics that studies decision-making in situations where multiple individuals or groups have conflicting interests. It seeks to analyze the strategic interactions between these parties, taking into account the potential gains and losses that each player may experience.

Game addiction has become a vital concern for scientists in recent years due to the widespread availability of video games and the increasing number of individuals affected by the condition. Studies have shown that game addiction can have serious negative consequences for an individual's physical, psychological, and social well-being. However, researchers are seen as very concerned and found debating on game addiction and discussing its prevention methods<sup>[16]</sup>. Furthermore, gamification, on the other hand, is the use of game design elements and mechanics in non-game contexts to engage and motivate people to achieve their goals<sup>[17]</sup>. It involves applying principles and techniques from game design to create an enjoyable and rewarding experience for users. In the same vein, additional theories involve elements that are based on certain needs, such as reciprocity, enjoyment, altruism, entertainment, and psychological empowerment (such as a sense of community, self-efficacy, and perceived importance), while others integrate extrinsic factors like rewards, payment, expertise, experience, and more.

In an innovative and multifaceted setting of CS, motivating a crowd is a challenge. It is important to integrate the motivational theories and their antecedents in crowdsourced innovative and popular platforms like autonomy from SDT and value of task from expectancy-value theory, which will be effective towards the completion of a specific task. Researchers have encountered a variety of issues while trying to keep solvers motivated to complete a task, and such challenges demotivate workers resulting in workers quitting, losing interest, or becoming redundant. Few studies have addressed such challenges by integrating features of two motivational theories, which have shown positive results and engagement<sup>[18]</sup>. Recently, researchers are found considering mediating and moderating the effects of motivational theories, where implemented theories mediate the relationship between motivational factors and the outcomes of crowd participation<sup>[19,20]</sup>. Although researchers have gained insights into exploiting crowd wisdom through experience and previous research, it has become more apparent that to accomplish a high success rate, new theories with more optimistic engagement guidelines must be introduced, or the implementation of legacy theories must be adjusted appropriately<sup>[21]</sup>.

Motivation theories that have been used for over a decade are identified in this literature study. We start with a thorough analysis of crowdsourcing-specific motivational theories, implications, and effectiveness. The significance of motivation, the effectiveness of these theories when applied online, and the characteristics upon which these theories base their motivation are all extracted from the identified theories. We also addressed the risks of nascent theories producing a long tail and the impact of popular theories in practice using the long tail hypothesis.

The article is structured as follows. In Section 1, a concise

overview of various motivational theories is provided, along with a summary of related research on the application of motivational theories and models for contributing to crowdsourcing platforms. Section 2 outlines the methodology of the research, including the research questions, criteria, and quality assessment. The background analysis of the results of the systematic literature review is presented in Section 3, and in Section 4, the research questions are discussed to evaluate the successful implementation of motivational theories using the long tail theory to identify popular theories, potential, and risks of emerging theories. The outcomes of the study are examined in Section 5, and Section 6 concludes the study.

## 1 Related Work

Motivation is a philosophical concept that is used to clarify the initiation, goal, intensity, persistence, and quality of behavior<sup>[22]</sup>. Motivation is viewed as multidimensional and is characterized by its variety and orientation, which are connected to the individual and their personal experiences<sup>[7]</sup>. The term motivation is derived from the Latin word "motivus", which means "to stimulate". Over time, the meaning and application of motivation have evolved as a result of many researchers exploring the concept in various fields of study. Motivation generally is defined as "a process that starts with a requirement or a physiological or psychological deficiency and the cause of activation of behavior either to a target or encourager<sup>[23]</sup>", or "a reason of stimulating, orientation, and maintaining human behavior towards achieving a goal".

As the concept of motivation evolved, researchers began categorizing the various motivational theories based on different aspects of behavior. One key aspect involves whether motivation energizes and/or directs behavior. Energizing refers to the maintenance and arousal aspects of motivation, while directional refers to the choices individuals make based on their motivation<sup>[24]</sup>. Other categorizations of motivational theories account for why people engage in one activity over another or why behavior can vary. These definitions aim to emphasize goal-oriented behavior, attraction by incentives, and adaptive consequences of motivation<sup>[25]</sup>.

Motivation is crucial in many areas of research, such as education, where it is considered a fundamental factor in learning. It is often used to describe how attentive and committed students are to certain learning activities. Many authors have emphasized the importance of motivation in these fields<sup>[26,27]</sup>. In education, it is the dynamic force of students' extent and the choices of their effort, engagement, and persistence in the learning process<sup>[17,28]</sup>. In industry, it is a measure of performance that affects individuals by influencing the efforts to allocate tasks<sup>[29]</sup>. Similarly, in society, social motivation helps workers to meet and build relationships with other people, as well as help solve problems, chat, work, and collaborate with other professionals<sup>[11,30]</sup>.

As the idea of motivation is relatively old, out of many, the most recognized theories that are identified from literature that has established and presented work to understand the psychology of motivation over the past are SDT<sup>[31-34]</sup>, game<sup>[35,36]</sup>, gamification<sup>[37,38]</sup>, social cognitive theory<sup>[38,39,40]</sup>, and EVT<sup>[9,41,42]</sup>. These theories have also shown to be valuable and have grown in favor over the last few decades. Though researchers have uncovered new opportunities that are currently considered by many, similarly, researchers are more concerned about the theories that are showing more promising results to motivate workers. Recent research has explored the integration and verification of various theories, including some that are related to game theory<sup>[31,43]</sup>, gamification<sup>[44,45]</sup>, long tail theory<sup>[46]</sup>, and item response theory<sup>[47,48]</sup>.

However, to determine the significance of theories and their contribution to motivating the crowd, Humayun et al.<sup>[49]</sup> identified prospective engagement models and mapped 36 identified motivational theories onto the models.

Researchers in the past have used different methods and features to motivate workers, meaning that they understand the importance of motivation, where human engagement is considered. The motivation level of workers is significant because it can influence their engagement with the task and enlighten human psychological characteristics which are determined by intrinsic and extrinsic motivational features. Theories of human behavior, when applied with regard to motivation, help determine workers' needs and influence their behavior. This, in turn, affects both the effort they put into completing tasks and the quality of their work. These features may be considered instrumental<sup>[50,51]</sup> and experiential<sup>[52]</sup>. Instrumental features are pragmatic, rewards, learning, increase in pay, and others. Similarly, experiential features provide a sense of pleasure, entertainment, joy, and others. Many researchers believe that certain features or factors are advantageous in achieving results in crowdsourcing. These features may be referred to as either "features" or "motivational factors" depending on the author. These theories are often taken into account by authors who utilize various offline, online, or hybrid platforms to engage with the population either fully or partially.

The widespread use of the internet and the availability of various platforms have transformed the way researchers conduct their work. With an abundance of information and resources at their disposal, researchers can access data from diverse sources, enabling a more thorough understanding of the issues they are investigating<sup>[53]</sup>. Similarly, researchers are actively seeking out new platforms that feature diverse demographics to achieve their research goals. By engaging with a wide range of people from different backgrounds and perspectives, researchers can gain valuable insights into the issues they are studying. This broad range of views can be particularly beneficial when attempting to understand complex problems from a global rather than a local perspective. To outreach people worldwide, researchers are looking into platforms that may be accessed using online or ubiquitous technology, where some are more concerned about the impact of artificial intelligence on various tasks<sup>[54]</sup>. Similarly, cyber-enabled computational intelligence is helpful to analyze the personalized activities performed in daily life. Semantic reasoning based approaches are essential for analyzing the confidence level and motivational aspects of the expected performance of an individual<sup>[55]</sup>. Moreover, platforms with vast knowledge and experience can provide researchers with additional resources and expertise that can enhance the quality and accuracy of their research. By leveraging these resources, researchers can gain a more profound understanding of the issues they are studying and make more informed conclusions. Crowdsourcing is a nascent model that has shown some very promising results and is becoming popular among the crowd.

Crowdsourcing is a problem-solving method that relies on tapping into the power of a large group of people, known as the crowd, to leverage their collective intelligence, skills, and knowledge<sup>[56]</sup>. Participants are typically recruited based on their experience, knowledge, and exposure to the issues being addressed on the crowdsourcing platform. This approach allows researchers and organizations to identify individuals with the relevant skills and expertise required to address the problem at hand, while also ensuring that a diverse range of perspectives and ideas are brought to the table. Traditionally, it is defined as "an online call for a

group of people to complete a task, using their resources"<sup>[57]</sup>. Others have defined crowdsourcing differently, Howe<sup>[12]</sup> explained crowdsourcing as "the practice of obtaining needed services, ideas, or content by soliciting contributions from a large group of people, and especially from an online community, rather than from traditional employees or suppliers". Erickson<sup>[58]</sup> defined crowdsourcing as "Tapping the perceptual, cognitive, or enactive abilities of many people to achieve a well-defined result such as solving a problem, classifying a data set, or producing a decision". Similarly, Noble<sup>[59]</sup> explained it as "a method of distributing problem-solving, allowing members of a community to collaborate across a global playing field to devise solutions".

Out of the most profound reasons for researchers to reach out to the crowd worker, a seeker is interested in the contribution, i.e., the creativity and capacity to solve a problem<sup>[60]</sup>. Similarly, a seeker wants to accomplish the desired goals and perceive his campaign to be successful. This recruitment of participants may take different means and methods, and recruitments may be feral or open calls to a specific demographic of participants on the selected platform. Most researchers tend to select social platforms like Facebook, Twitter, and others for the call<sup>[61]</sup>. Selection criteria further lead to interviewing based on education, age, experience, and other factors. Governments use crowdsourcing platforms for two primary purposes, as outlined by Aitamurto and Landmore<sup>[62]</sup>. Firstly, for policy development, leverage the collective knowledge of the public. Secondly, promote civic engagement. When employed for policymaking, crowdsourcing has two main objectives, including complementing and enhancing the policymaking process<sup>[63,64]</sup>. Similarly, crowdsourcing, when used for marketing, results in brand awareness and employing current advertising messages<sup>[65]</sup>. Lastly, when it is used in industry, it is used for developing business strategies and co-creation for innovation<sup>[66]</sup>.

Motivating the crowd in crowdsourcing involves a combination of internal and external drivers. The factors that contribute to motivation can be classified as actionable or non-actionable. Actionable motivations fall into two categories, namely intrinsic and extrinsic<sup>[67]</sup>. Non-actionable motivations, on the other hand, include introjected and identified motivations. Intrinsic motivation involves performing an activity for one's benefit, while extrinsic motivation is driven by incentives such as monetary rewards, personal needs, or the desire to develop one's skills or reputation<sup>[7,68]</sup>. Introjected motivation is more internalized and may lead to feelings of guilt when not followed through, whereas identified motivation involves recognizing the need to take action without having a clear plan in place.

## 2 Review Methodology

Reviewing past research has an incentive for any type of study<sup>[69]</sup> since writing literature reviews can benefit one to identify and improve what recent research work had been done<sup>[70]</sup>. Our Systematic Literature Review (SLR) is aligned with the methodology outlined by Ref. [71]. Starting with the elucidation of our research questions, next, we perform the selection and identification of relevant primary studies, thereof synthesizing results derived from the selected studies. We finally explore our Research Questions (RQ) and address them through meta-analysis.

### 2.1 Research questions

RQ1: How have motivational theories been addressed in the research literature on crowdsourcing?

RQ2: Which motivational theories have been applied to

crowdsourcing and when were they first cited in the literature?

RQ3: How does the long tail theory using the Pareto principle help to identify the effect of popular motivational theories?

The first two research questions will primarily be helpful to researchers interested in the implementation of theories in their work. The last questions will address the risks and opportunities concerning practitioners and researchers both.

2.2 Search process

In order to ensure the inclusion of fine-quality literature in the search process, we conducted searches of conference proceedings and academic journals within the field of natural sciences, using databases such as Science Direct, Association of Computer Machinery (ACM), Springer Link, and Scopus. Our search covered the period from January 2010 to 2021. For instance, we used ACM to access computer-related journals and Science Direct to access publications in the fields of computing and engineering.

(1) Keyword search

We searched the above-mentioned databases using “AND” and “OR” combinations of keywords, and our key search string is: (“motivation” OR “inspiration”) AND (“theory” OR “theories”) AND (“crowdsourcing” OR “crowdsourced”).

We started our research on motivational theories in crowdsourcing by using the keywords “motivation”, “theories”, and “crowdsourcing”. We also added “motivation” and “inspiration” because these terms are frequently used by authors in this context. Additionally, we included “crowdsourced” and “crowdsourcing” to highlight the role of the crowd in this IT-enabled form of open innovation, which has gained attention from researchers and practitioners in the past decade<sup>[73]</sup>.

The search initially yielded 4639 results from all databases, but after narrowing it down to natural sciences domains, it was reduced to 673. Duplicate removal and analyzing the meta-information of all research papers, such as keywords, titles, and abstracts, were done to classify their significance in comprehending the fundamental concept of motivation and inspiration in crowdsourcing using theories or philosophies. This further reduced the number of relevant papers to 115.

During the screening, the article was read for the relevance of the research articles. Selection is based on the consideration that the articles at hand have considered a motivational theory and factors, especially in the open innovation of the crowdsourcing context. After the two screening processes, the number of relevant papers was further reduced to 98 due to ambiguous abstract or keyword selection. We then conducted a backward and forward search on the initially selected 115 papers, resulting in an

additional 24 articles to the selected 98 papers, and this step was taken on the suggestions by Okoli<sup>[74]</sup> and Webster and Watson<sup>[69]</sup>. A third screening process was carried out on the remaining 122 papers to identify those that have discussed the implementation of motivational theories on crowdsourcing with clear results showing the importance of theories and their antecedents. This process narrowed down the number of selected papers to 91, as depicted in Fig. 1, which abridges the screening process and literature selection of SLR.

(2) Repository selection and search policy

The purpose of the study was to gather relevant data on the integration of motivation theories and co-creation in crowdsourcing, for which we explored the domain of natural sciences and performed a literature review. To analyze the data, we used the grounded theory’s open coding, which involves the construction of definitions and categories based on properties found in the textual data. The qualitative data analysis process resulted in a coding scheme that identified keywords as properties and assigned the findings to a relevant category<sup>[74]</sup>. The goal was to identify common themes and patterns in the data related to motivational theories in crowdsourcing.

In the literature search process, 91 papers were identified by two coders, the author and an external person with the PhD degree, who then categorized the papers into those that examined motivation and theories or both using crowdsourcing. Any disagreements were resolved through constructive debate. The intercoder reliability was assessed using Krippendorff’s alpha, which had an average value of 0.82, indicating an acceptable level of reliability. The review highlights 35 motivational theories out of which 22 papers solely implemented self-determination theory, 13 papers implemented game theory, 9 papers implemented gamification artifacts, and 5 papers implemented expectancy-value theory, with 31 other theories, respectively (see Table 1).

During the literature search, we identified 91 papers that are relevant to our study on motivational theories in the context of crowdsourcing.

In the qualitative data analysis process, we aimed to identify specific theories used in the literature on crowdsourcing platforms. Each identified theory was then searched and its philosophy was read, and it was assigned to relevant categories based on its continuum theory or part of a larger set. For example, principal-agent theory is a subset of incentive theory, and social identity theory is a subset of social theory. This indicates that researchers tend to apply these theories selectively rather than use them in their entirety to motivate the crowd. Adopting such an approach in other fields such as management, academia, and

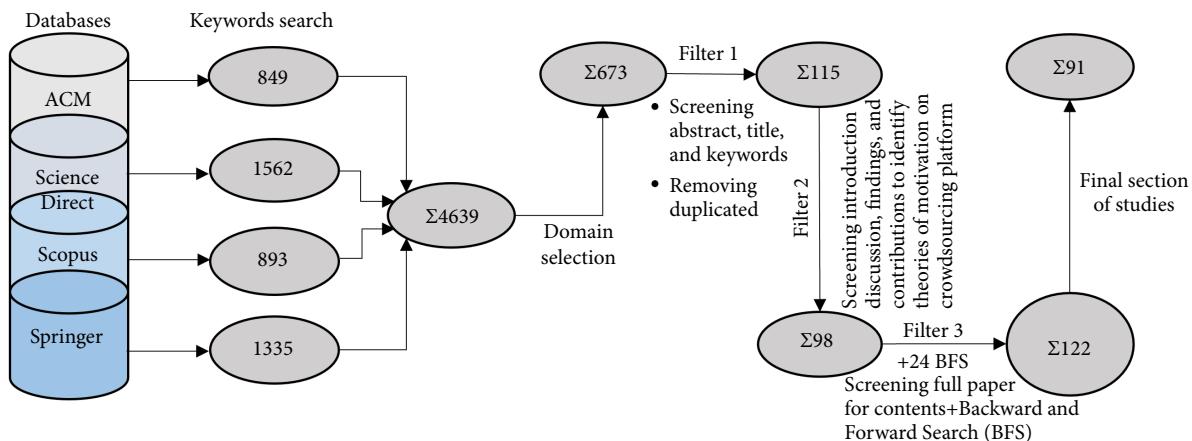


Fig. 1 SLR screening and selection.

**Table 1 Practiced theories of motivation in crowdsourcing from selected studies.**

No.	Motivational theory from selected study	Sum	Reference
1	Behavior change theory	3	[11, 75, 76]
2	Decision theory	2	[77, 78]
3	Expectancy-value theory	5	[32, 41, 42, 79, 80]
4	Game theory	13	[61, 81–92]
5	***Gamification theory	9	[18, 35, 37, 38, 44, 51, 93–95]
6	*Gratification theory	1	[96]
7	*Identity theory	1	[97]
8	Incentive theory	3	[98–100]
9	**Information theory	1	[101]
10	Item response theory	2	[47, 48]
11	*Learning theory	1	[102]
12	Long tail theory	2	[46, 59]
13	*Measurement theory and statics	1	[103]
14	*Norm theory	1	[104]
15	*Protection motivation theory	1	[105]
16	*Random graph theory	1	[106]
17	Reinforcement sensitivity theory	2	[107, 108]
18	***Self-determination theory	22	[18, 31, 33, 34, 51, 93, 109–124]
19	*Social choice theory	1	[125]
20	Social cognitive theory	2	[28, 39]
21	Social exchange theory	2	[126, 127]
22	Social identity theory	2	[128, 129]
23	**Social interdependence theory	1	[130]
24	*Social learning theory	1	[131]
25	*Social power theory	1	[132]
26	*Structuration theory	1	[133]
27	*Technology threat avoidance theory	1	[134]
28	*Theory of Legitimate Peripheral Participation (LPP)	1	[135]
29	*Theory of motivation and volition	1	[43]
30	Theory of organizational behavior	2	[72, 136]
31	Theory of planned behavior	2	[137, 138]
32	Transaction cost theory	2	[53, 139]
33	**Two-factor theory	1	[140]
34	**Unified Theory of Acceptance and Use of Technology (UTAUT)	1	[141]
35	**Value chain theory	1	[142]
–	Total studies	94	–

Note: \*New theories except for the year 2019. \*\* New theories appeared in 2019 only. \*\*\* Study implementing two theories.

industry can assist researchers in designing better crowd engagement experiences. In the second phase of our qualitative data analysis process, the first author and an external coder independently coded each paper's research onto the crowdsourcing contribution model.

### (3) Inclusion and exclusion criteria

To determine whether a study should be considered in our review, the following criteria were applied.

(a) The study should be published in English, between 2010 and 2021.

(b) The study must address a motivational theory explicitly.

(c) The full content of the study must be accessible.

(d) The study should include computer sciences and engineering domains.

(e) The study should have applied motivating theories in crowdsourcing.

(f) The study should be published in journals and conference proceedings with prior research.

(g) The study must report the outcomes in sufficient detail to support meta-analysis.

### 2.3 Quality assessment

Each included study is assessed following a common quality checklist. The study's implementation of the theories is evaluated

to determine whether it yields clear, ambiguous, or mixed conclusions based on the data and reasoning, and scoring is done, respectively. Table 2 displays the quality ratings assigned to the 91 papers.

Overall, the literature review’s research demonstrates that the quality of 75% of studies generally falls between the good and excellent grading ranges.

### 3 Pilot Finding

This section summarizes the preliminary findings from our literature review investigation, which we considered deemed important, to understand the scope of the study.

#### 3.1 Temporal view

It can be deduced by observing Fig. 2 that there is a growth in literature over the past years. Researchers and practitioners have considered much of the work on implementing theories of motivation in crowdsourcing.

The frequency of papers per year from Fig. 2 indicates that initial studies on motivational theories were successful in

Table 2 Quality assessment of accepted papers.

Qualitative (score)	Number of studies	Percentage of papers (%)
Fair (< 45%)	21	23.08
Good (45%–70%)	41	45.06
Excellent (> 70%)	29	31.86
Total	91	100.00

achieving their objectives, which led to their continued use over the years. This trend highlights a growing awareness of the importance of motivational theories in the context of crowdsourcing. Moreover, the increase in published papers may encourage the exploration and validation of new motivational theories in the crowdsourcing environment.

#### 3.2 Data foundation

Our analysis of the 91 publications obtained from the literature search indicates that the majority of research on motivational theories in crowdsourcing is published in reputable journals such as *Human-Computer Interaction*, *Social Computing*, and *ACM Transactions on Economics and Computation* in the ACM Digital Library. In Scopus, the *Journal of Computer Information Systems* and *International Journal of Human-Computer Studies* are the prime sources. While in Science Direct, much of the literature is provided by the journal of *Computer in Human Behavior*. *Frontiers of Computer Science* and *Springer Nature* are Springer Link journals that have considered studies on motivational theories. However, it can be argued that a paucity of work is found in conference proceedings. Similarly, no conference study is found in the Science Direct database during the SLR conduct.

#### 3.3 Geographical distribution of papers

According to Fig. 3, the USA and China account for a significant share of the scientific research, i.e., 28% and 26% we reviewed, followed by Singapore, Australia, and the UK at 6% and the remaining 19 countries at 28%, out of 109 entries. The study modifies the results of a few studies that offer a largely worldwide

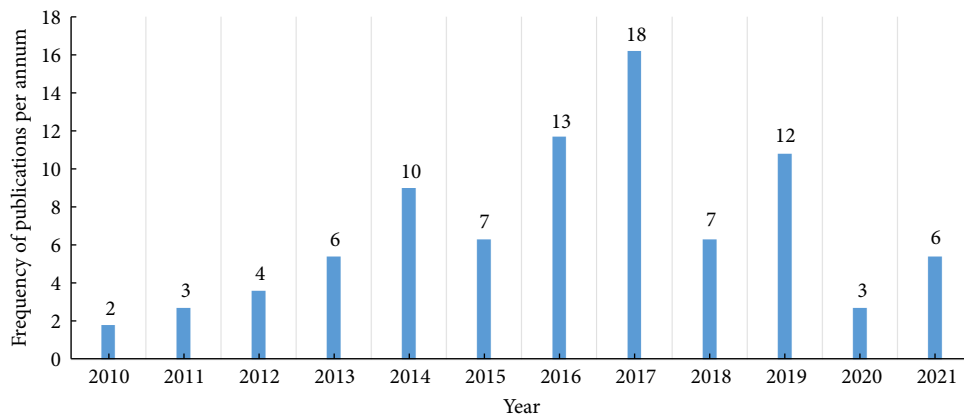


Fig. 2 Inclusion of selected papers per year for the literature review.

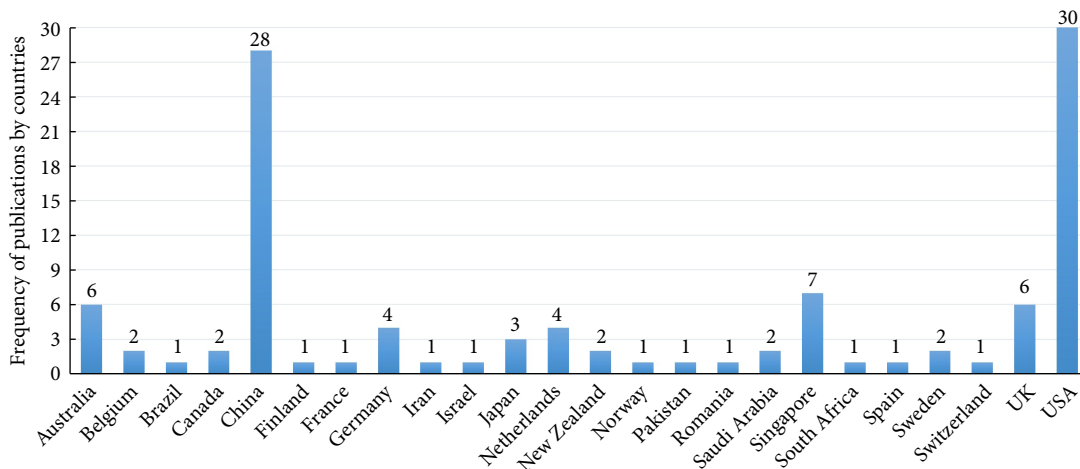


Fig. 3 Representation of countries from selected studies.

perspective on the application of motivational theories in crowdsourcing.

#### 4 Result

Our research questions are summarized in Fig. 4, which gives an overview to help understand the research.

The aim of this study is to investigate three research questions illustrated in Fig. 4 to provide a comprehensive analysis of the studies conducted on motivational theories in the context of crowdsourcing over the past ten years. To accomplish this, we categorized the chosen papers based on the type of publication that used motivation theories in the context of crowdsourcing (RQ1), and systematically examined the theories utilized and their applications in the crowdsourcing environment during the last decade (RQ2). These two research questions lead to the investigation of the impact of the top 20% of theories that contribute to 80% of the emerging theories.

##### 4.1 RQ1: How have motivational theories been addressed in the research literature on crowdsourcing?

The research has identified 91 papers that have implemented motivational theories in crowdsourcing, and to answer our first research question (RQ1), we have categorized the selected studies based on publishing trends. The papers span from 2010 to 2021 and are presented in Fig. 5 and Table 3.

Figure 5 indicates that although there is a significant occurrence of conference publications, journal publications are more prevalent. Conferences show that there are new ideas for implementing nascent theories on the horizon. Whereas, periodic journal publications demonstrate a greater focus on the topic of motivational theories in crowdsourcing and a higher level of rigor.

However, by analyzing the graph using a moving average of 2 (see Fig. 5), it can be observed that the recent overall growth of journal publications is far better than conference publications.

Figure 6 displays the quantity of conference and journal publications found in the selected studies. It is evident that ACM Digital has a substantial number of publications in conferences, as it includes renowned platforms presented in International Conferences such as E-business, Management, and Economics (ICEME), Computer-Supported Cooperative Work (CSCW), and ACM Conference on Human Factors in Computing Systems (CHI).

The total number of occurrences for CHI in the ACM Digital conference is three, with the earliest published work found in the year 2011. For CSCW, there are four occurrences, with the first work being published in 2013, and for ICEME, there are two occurrences with the first work being published in 2017. On the other hand, no conference publications were found in the Science Direct database, which suggests that Science Direct journals are more favored by authors for high-level research and recognition. However, the Scopus database reflects a balanced interest among authors in both conferences and journals, with a total of 31 publications overall. The first conference publication was found in 2011, while the first journal publication was found in 2012. Finally, Springer Link contains fewer publications compared to other databases, with the first conference publication found in 2012 and the first journal publication found in 2013.

##### 4.2 RQ2: Which motivational theories have been applied to crowdsourcing and when were they first cited in the literature?

Out of the 91 articles selected, some theories are found to be new to crowdsourcing whereas others had been previously studied in other fields, as discussed in Section 2. The research question 2

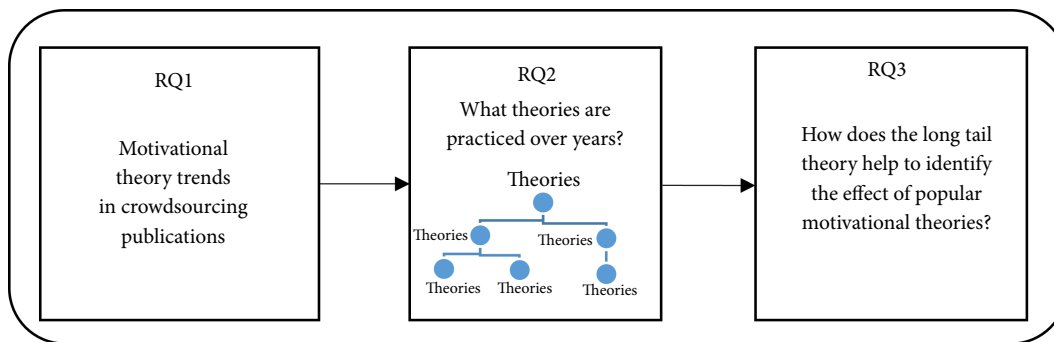


Fig. 4 Relationship between the research questions.

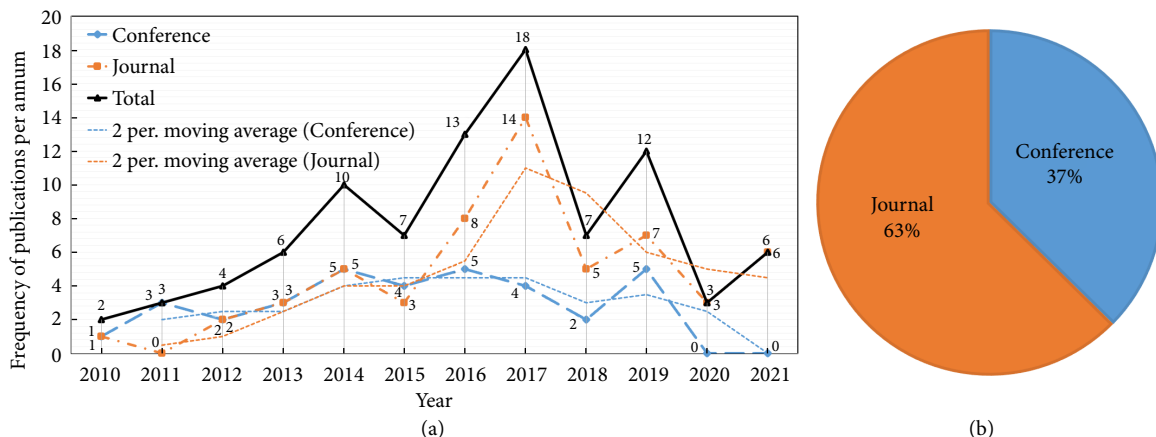


Fig. 5 Motivational theories trends in crowdsourcing during 2010–2021.

**Table 3 Publication of selected papers by type and year.**

Year	Frequency of publication		
	Conference	Journal	Total
2010	1	1	2
2011	3	0	3
2012	2	2	4
2013	3	3	6
2014	5	5	10
2015	4	3	7
2016	5	8	13
2017	4	14	18
2018	2	5	7
2019	5	7	12
2020	0	3	3
2021	0	6	6
<b>Total</b>	<b>34</b>	<b>57</b>	<b>91</b>

(RQ2) was answered by identifying 35 unique motivational theories implemented in the selected papers.

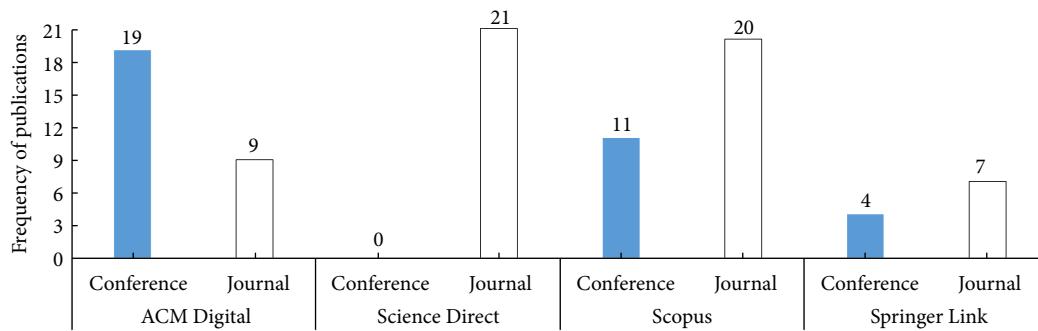
SDT was the most frequently practiced theory, with a frequency of 22, followed by game theory (13), gamification theory (9), and EVT (5). While gamification and game theories have appealing

philosophies to attract new generation using game elements and social theories focusing on social aspects have a high frequency, researchers tend to focus more on SDT and its features, as it focuses on autonomy, competence, and relatedness which have produced better results so far. The 2nd column “Motivational theory from selected study” in Table 1 indicates papers that have implemented two theories in their research and study references are shown using “\*\*\*”.

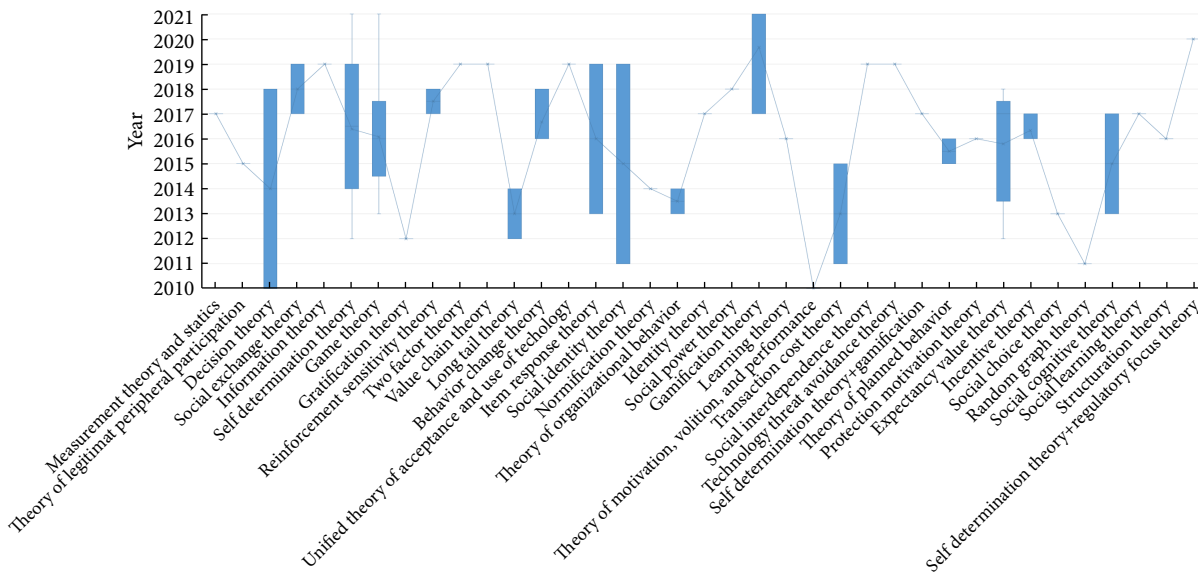
RQ2 has identified the presence of theories per year, as shown in Fig. 7, with a total of 35 theories identified. Compared to earlier years over the decade, studies published during 2016–2019 show more growth in the implementation of theories that could inculcate motivation among crowd workers in crowdsourcing. Researchers are expected to see improved engagement in results by focusing more on motivational theories in a crowdsourcing environment based on the data presented in Figs. 2 and 7, and Table 3.

The mapping of the results from Table 1 onto Fig. 7 helps us understand that the theory most frequently selected for crowdsourcing and best suited to meet the crowd’s needs is SDT. Research on SDT has been consistently observed every year from 2012 to 2021, with the highest frequency of 22 among all motivational theories, except for the year 2015. This consistent trend indicates that SDT is the preferred choice, and researchers are comfortable implementing it in crowdsourcing to motivate the crowd effectively.

Another notable theory that stands out in the results is game theory. The evidence demonstrates that game theory gained



**Fig. 6 Publication trends from selected databases.**



**Fig. 7 First appearance of the theories in crowdsourcing environment (2010–2021).**



recognition in 2013 and has been consistently practiced every year, except in 2020, showcasing its enduring popularity. Additionally, gamification is a theory that is gaining traction, particularly through the utilization of game artifacts like points, badges, and leaderboards. The results highlight that game artifacts, employed in gamification, are increasingly popular. Out of the 9 papers on gamification, it is evident that researchers began to widely adopt and appreciate it, especially from the year 2017 onwards, and it continues to be in the limelight.

### 4.3 RQ3: How does the long tail theory using the Pareto principle help to identify the effect of popular motivational theories?

The third research question (RQ3) is about how the long tail distribution justifies the Pareto principal implementation of motivational theories in the crowdsourcing environment. The 35 motivational theories in Fig. 8 show the asymmetric distribution of data with the positive skewness = 3.7, and the mean value AVG = 2.4, which justifies the 80/20 principle, the 20% signifies the seven most popular motivational theories, namely STD, EVT, game, gamification, behavior change, and incentive theory, while the 80% rest creating a long tail.

The distribution indicates that theories with a higher effect represent the head, and several new and nascent theories of interest have been shown to have a long-tailed distribution. We also analyzed the distribution of the curve using kurtosis = 15.1, which explains the phenomena of excess kurtosis. The excess kurtosis having a value larger than 3 tends to have a fat tail, which is shown in Fig. 8, identifying the theories' appearances more frequently than a normal distribution.

The analysis of popular theories applied in the selected studies reveals that researchers have used SDT more frequently (mean = 3.67 and standard deviation (SD) = 1.89), followed by game theory (mean = 2.17 and SD = 2.19), EVT (mean = 0.83 and SD = 1.07), gamification (mean = 1.50 and SD = 1.50), behavior change theory (mean = 0.50 and SD = 1.12), and incentive theory (mean = 0.50 and SD = 0.76), respectively. It can be deduced that the long tail theory is the one which is causing the effect, making the 20% of the theories invigorating, as there is less work and results found in long tail, creating a leap and interest in the theories which have shown a significant work and maturity.

To further the work, we performed a Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis on the theories creating a long tail to identify the risks associated to enhance such theories' impact on crowdsourcing. We performed an SWOT framework on 10 theories distributed over long tail as shown in Table 4, which has a frequency equals to 2, from selected studies. Table 4 helps us to identify the internal and external focus of the base theories. The risk analysis of the theories helped to deduce the focus of the theories that are non-influential in practice at a given time and problem space.

## 5 Discussion

To better comprehend the theories and their underlying construct in the crowdsourcing environment, this section reviews the literature from our study and expands on the findings from the prior section.

### 5.1 RQ1: Publication and its trends

The 91 papers analyzed in this study were categorized into two groups: conference papers and journal articles. Figure 5 reveals that from 2010 to 2021, more high-impact papers were published in journals than in conferences to support the implementation of theories in crowdsourcing. The analysis suggests that research published in journals tends to be more focused on the topic of motivational theories in crowdsourcing and thus has a higher level of integrity than conference publications. However, some highly rated conferences such as CHI and CSCW were also represented in the selected studies. For instance, Karim et al.<sup>[42]</sup>, Lee et al.<sup>[126]</sup>, and Zhang and Zhang<sup>[139]</sup> presented their work at IEEE conferences, Noble<sup>[59]</sup>, Gilbert<sup>[143]</sup>, Preist et al.<sup>[104]</sup>, and Howe<sup>[144]</sup> presented their work in CSCW, and Vries et al.<sup>[145]</sup>, Starbird and Palen<sup>[128]</sup>, and Kim et al.<sup>[78]</sup> presented their work in CHI. Figure 9 provides an overview of the overall publications in conferences and journals, showing that journal publications reached a maximum of 19 and conference publications reached a maximum of 5. Figure 9 also illustrates the growth in publications between 2010 and 2021, indicating that researchers are increasingly interested in implementing motivational theories and testing them in crowdsourcing environments. Furthermore, the number of journal publications has been increasing steadily since 2013.

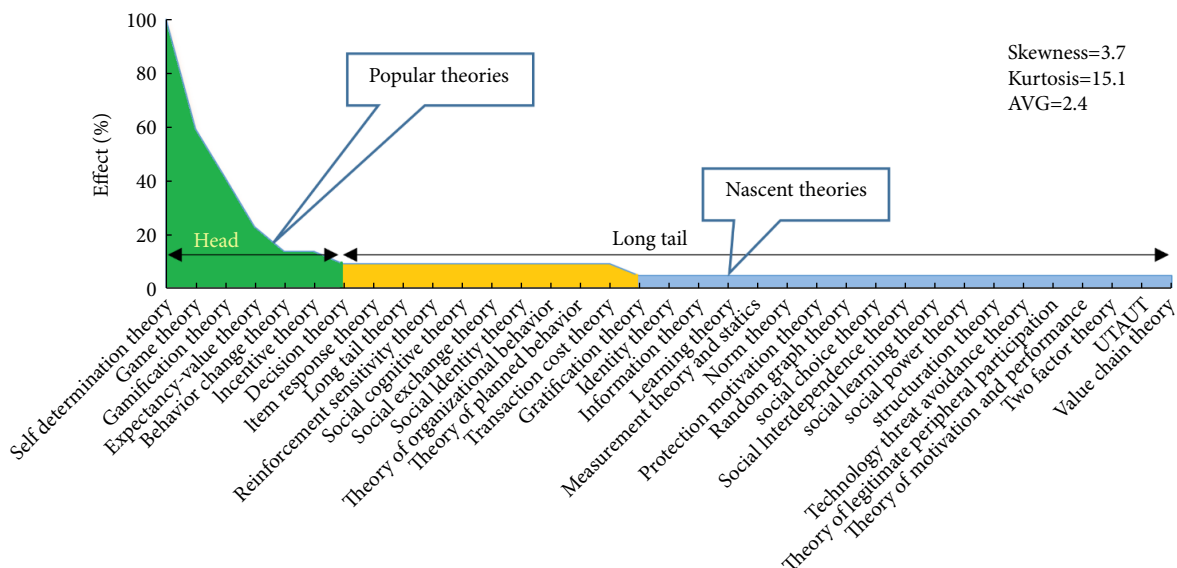


Fig. 8 Long tail distribution of the most popular theories and long tail.

Table 4 SWOT analysis of long tail theory.

No.	Theory	Strength	Weakness	Opportunity	Threat	Reference
1	Decision theory	Energization of goal-orientated behavior	External features of motivation may affect performance	Job opportunities, motivating employees for quality, and motivating workers for more productivity	Complex scenarios, direct assessment of motivation, and decision reflection measurement	[77, 132]
2	Item response theory	Measurement of ability and attitudes	Designing of tests or questioners and fitness or data to model	Measure general intelligence or the strength of an attitude	Variable complexity or of tasks	[128, 138]
3	Long tail theory	Describe popular items with relatively small quantities	Understanding the sense of the long tail distribution	Modification of relationships and evaluating the impact on the frequency of events	-	[32, 141]
4	Reinforcement sensitivity theory	Stimuli of behavior toward reward, punishment, and motivation	Association between two primary motivational systems	Learning individual differences in human personality	Separating subsets of reinforcement	[83, 110]
5	Social cognitive theory	Individual's knowledge to observe others	Differentiation of negative and positive behavior	Engage in behavior previously learned	Success or failure in practice	[116, 119]
6	Social exchange theory	Social interaction to identify risks and benefits	Identification of cost and benefit	Identify the value of items	Production of positive or negative feelings	[51, 126]
7	Social identity theory	A person thinks of himself as an individual or as a part of a group	Strive for a positive self-concept	Change of individual's behaviors or concepts due to attachment to a group	Self-interest	[104, 120]
8	Theory of organizational behavior	Human behavior in an organizational setting	Evaluation of performance	Chance to absorb appreciated behaviors of organization and group	Organizational or group politics	[97, 125]
9	Theory of planned behavior	Predict an individual's intention to participate in an activity	Limited variables to account for behavioral intentions	Ability to exert self-control over any behaviors	No account for actual control over the behavior	[79, 87]
10	Transaction cost theory	Account for the internalized transaction of finances and services	Initialization of activities	Self-interest with intelligence with bounded rationality and opportunity	Past governance affects decisions	[46, 127]

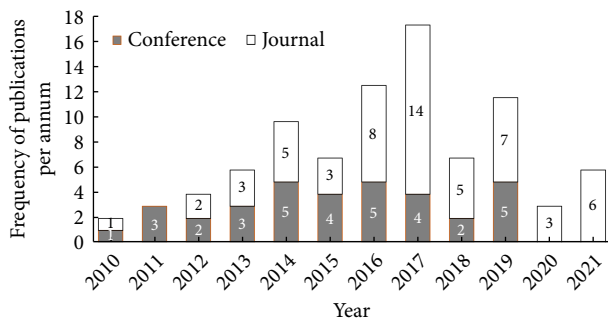


Fig. 9 Publications per year of selected studies.

5.2 RQ2: Theories of motivation in crowdsourcing

The exclusively identified motivational theories are presented in Table 1 from the 91 papers, which were consolidated into 35 theories after careful examination. Some of the theories were found to be continuums of other theories like cognitive evaluation theory, and need theory is a continuum of SDT. The theory that is observed in the work of Crowston and Fagnot<sup>[11]</sup> and Pang and Liu<sup>[9]</sup>, who used the helping behavior theory in their article, is a continuum of behavior change theory, while the latter used the principle agent theory to influence behavior. Additionally, Goes

et al.<sup>[100]</sup> used the goal-setting theory, which is a continuum of the incentive theory. Researchers, such as Posch et al.<sup>[109]</sup> and Prince et al.<sup>[116]</sup>, addressed the continuum features of SDT, while Kim and Ahn<sup>[5]</sup> addressed the continuum features of gamification theory, like joy and autonomy which were further elaborated by Guay et al.<sup>[146]</sup>

It is also identified that some theories address the larger aspect of motivation by introducing a concept addressed in similar theories. Behavioral change is practiced by many theories focusing on behavioral, personal, and environmental characteristics factors to determine behavioral aspects. Such theories that could influence the behavior of a crowd worker are identified as the theory of planned behavior, social power theory, theory of organizational behavior, and others.

The application of motivational theories in crowdsourcing has seen an exponential increase over the years, as indicated by Fig. 9. Although these theories may not be new in other domains of study, they are considered new and nascent in the crowdsourcing environment. The popularity of the theories can be judged from Table 1, where it is evident that game theory is at 13.8%, gamification is at 9.6%, SDT is practiced at 23.4%, and EVT is at 5.3%. It is observed that game theory and SDT are more rigorously used over the past years, indicating researchers' interest in achieving better engagement and results than other theories.

The authors expect that the rise of new theories may have a better effect on the factors considered pitfalls in the two theories. Although there is much more potential in gamification artifacts, careful consideration is required to deploy them over the platforms, as not many platforms are empowering gamification and have those motivational factors which can help researcher achieve far better results while engaging the crowd in such arrangements.

In Table 1, the motivational theories that have been applied in crowdsourcing are presented along with their frequency. The theories that have appeared only once are considered new and nascent to crowdsourcing and are marked with a single asterisk (\*). However, the theories published in 2019 are much more than the work presented over a decade, and hence for identification they are marked with a double asterisk (\*\*). Over all, these new theories account for 19 out of 35 theories, which is 54.2% of the total, while 6 new theories were identified from its over all frequency of 12 in 2019, contributing 31.5% out of 19 new and nascent theories. This indicates that there has been a significant increase in the application of new theories in crowdsourcing from 2010 to 2021. Therefore, it can be inferred that researchers are working towards implementing new theories and improving existing ones in order to achieve better results in the field. Out of these 19 latest theories, 6 were practiced in the year 2019, 1 appeared in the year 2018, 3 appeared in 2017, 3 appeared in 2016, and the rest 6 theories appeared only once every year, i.e., in the years 2011, 2012, 2013, and 2015, and twice in 2014.

Such new theories were presented in 2019, such as the social independence theory<sup>[130]</sup>, which aided in organizing contests and gathering creative ideas online, and the value chain theory<sup>[142]</sup>, which has proven to be significant in education and industry, have gained popularity, the informational theory<sup>[101]</sup>, which focused on information dissemination and verification, and the two-factor theory<sup>[140]</sup>, which helped identify influential features for the crowd. Therefore, it can be concluded that these theories hold promise for future research, but it is crucial for researchers to conduct thorough validation and establish their validity.

### 5.3 RQ3: Long tail distribution

Anderson's theory of long tail<sup>[47]</sup> was applied to the selected theories. The distribution analysis shows that large occurrences of nascent theories taper off gradually, which is a subset of heavy-tailed distribution. The volume of every long-tailed theory suggests a large number of practices of new and nascent theories, yet identifying theories that are less contrivance in a crowdsourcing environment.

The distribution of the long tail theory is in line with the Pareto principle. The distribution study reveals that theories with substantial occurrences, exceeding 50%, follow the Pareto principle where approximately 80% of occurrences are attributed to the initial 20% of theories in the distribution. Though the unusual part of the long tail distribution is that the most frequently occurring 20% of theories represent less than half of occurrences, the least frequently occurring 80% of theories are more popular as a proportion of the total number of theories. The 20% of theories (head) becoming popular is the cause of the long tail, which concurs with the reasons that these theories have been applied in the literature successfully over long periods, with a large number of research and results. Yet the integration of such theories may be suboptimal in scenarios yet to be identified in harnessing the motivation.

The power law suggests the motivation strategy that allows the researchers to practice significant theories which are 80%, to overcome the gaps of motivation associated with a reduced number of popular theories. The SWOT analysis highlights the strengths, weaknesses, opportunities, and threats of a large number of less popular theories to enhance their popularity by helping researchers to realize the major factors associated with the theories. Likewise, the concept of tail risk implies that the distribution of theories is non-normal and exhibits a skewed pattern with heavier tails. These thicker tails signify that there is a possibility, albeit small, that researchers' focus may shift beyond widely accepted theories.

### 5.4 Research findings on motivational theories in crowdsourcing

The list of the most popular theories is presented in Table 1 and Fig. 8. Considering the research finding for all the theories would be a hefty process, therefore, the top six popular motivational theories that form the head of the long tail, i.e., SDT, game theory, gamification, EVT, behavioral change theory, and incentive theory, are selected and discussed below.

Recent research that has applied SDT in crowdsourcing to understand individuals' motivation and engagement in crowdsourcing activities approves some key findings related to its theoretical factors that include autonomy and motivation, competence and learning, and relatedness and social support.

Studies have found that giving individuals autonomy in crowdsourcing tasks can boost their motivation and engagement. This can be achieved by allowing individuals to select the tasks they want to work on, providing them with clear guidelines and objectives, and offering feedback on their performance<sup>[148]</sup>. Crowdsourcing tasks can provide individuals with opportunities to learn new skills and enhance their competence. Providing feedback on performance and clear instructions can increase individuals' competence and confidence in performing crowdsourcing tasks<sup>[136]</sup>. Crowdsourcing can also help individuals build social relationships and connections with others. Research has shown that providing social support through online communities and forums can enhance individuals' sense of relatedness and engagement in crowdsourcing tasks<sup>[149]</sup>.

Game theory has been used to design better incentive mechanisms for crowdsourcing tasks. A recent study proposed a "crowd auction" mechanism that uses game theory to allocate tasks to contributors fairly and efficiently. The mechanism accounts for the heterogeneity of contributors' skills and preferences and incentivizes them to bid truthfully for tasks<sup>[19]</sup>. Game theory has also been used to model coordination and cooperation among contributors in crowdsourcing tasks. A game-theoretic model of task assignment that considers the benefits of collaboration and the risks of free-riding was proposed. The model shows that assigning tasks to contributors based on their reputations and social connections can improve coordination and cooperation<sup>[61]</sup>. Game theory can be used to study the impact of information sharing on crowdsourcing outcomes. A game-theoretic model of information sharing in a crowdsourcing contest shows that sharing information about task difficulty can improve the efficiency and fairness of the contest and incentivize contributors to perform better<sup>[150]</sup>.

Although many of the recent trends of research have considered the motivation of workers' participation using gamification and factors that are employed in the research. A

study by Kim and Ahn<sup>[51]</sup> examined the effect of gamification on motivation and engagement in crowdsourcing tasks. The results showed that gamification can increase motivation and engagement and lead to better performance and higher-quality work. Similarly, research claims that gamification not only motivates workers but also helps to sustain participation<sup>[36,37]</sup>, opening new horizons for researchers to investigate. Similarly, another study investigated the role of social influence in gamified crowdsourcing. The results showed that social influence can enhance the effectiveness of gamification in promoting user engagement and participation<sup>[151]</sup>. Similarly, a study analyzed the design elements of gamified crowdsourcing platforms. The results showed that certain design elements, such as challenges and rewards, can increase user motivation and engagement, while others, such as excessive competition, can have a negative effect<sup>[86]</sup>.

The EVT of motivation explains the relationship between individuals' actions and the value they perceive in performing a task. Some recent research findings on expectancy-value theory in crowdsourcing examined the factors that influence task selection in crowdsourcing. The results showed that contributors' task preferences are influenced by their expectations about task difficulty, reward, and their ability to complete the task<sup>[80]</sup>. Another study applied EVT to the analysis of contributors' performance and effort in crowdsourcing. The results showed that contributors' task performance and effort are influenced by their expectations of task difficulty, reward, and ability, as well as their perceived value of the task<sup>[35]</sup>. Similarly, a study investigated the role of expectancy-value theory in shaping contributors' trust and satisfaction in crowdsourcing. The results showed that contributors' trust and satisfaction are influenced by their expectations about the quality of the task, the reliability of the platform, and their ability to complete the task<sup>[152]</sup>.

Behavioral change theory is a psychological framework that seeks to explain and predict human behavior and is often used in designing interventions to promote behavior change. Some of the recent research findings on the application of behavioral change theory in crowdsourcing show how much intrinsic factors influence contributors' behavior, which becomes the reason for workers to keep participating in crowdsourcing, such as self-presentation and self-recognition<sup>[153]</sup>. Another study investigated the role of social norms in shaping contributors' behavior in crowdsourcing. The results showed that social norms, such as the expectations of other contributors or the perceived approval of the task requester, can influence contributors' behavior and lead to greater task participation<sup>[154]</sup>.

Incentive theory explains how rewards and punishments can motivate or demotivate behavior. Some recent research findings on the application of incentive theory in crowdsourcing examined the effect of different incentive design strategies on contributors' behavior in crowdsourcing. The results show the importance of flexible incentives to improve crowdsourced participation and suggest that focusing on a single incentive type can influence workers' behavior and solution quality<sup>[155]</sup>. Another study investigated the role of social comparison in incentivizing contributors' behavior in crowdsourcing. The results showed that providing contributors with feedback on their performance relative to their peers can increase their motivation and task performance<sup>[158]</sup>. Lastly, a study analyzed the importance of incentive compatibility in crowdsourcing platforms, which refers to the alignment of the platform's objectives with those of the contributors. The results showed that platforms that are designed to be more incentive compatible can lead to greater participation in crowdsourcing<sup>[156]</sup>.

## 5.5 Future research

Future research is proposed based on the popular theories selected in the above Section 5.4. The findings suggest that to effectively apply SDT in crowdsourcing research, future studies can consider the following suggestions:

First, SDT proposes that intrinsic motivation is preferable to extrinsic motivation, but many crowdsourcing platforms provide monetary rewards or other incentives to encourage participation. While some studies suggested that rewards may undermine intrinsic motivation, others have found that they can enhance motivation by providing a sense of competence and autonomy. Second, SDT emphasizes the importance of relatedness or a sense of connection and belonging with others. In crowdsourcing, social support can take the form of feedback, recognition, and collaboration with other contributors. However, the impact of social support on motivation is not always consistent across studies. Lastly, SDT proposes that individuals differ in their inherent needs for autonomy, competence, and relatedness, which can affect their motivation and engagement. Nevertheless, it is not well established how individual differences predict participation and success in crowdsourcing.

By considering these suggestions, future research can effectively apply SDT to understand the motivational factors involved in crowdsourcing and improve the design of crowdsourcing to enhance participation.

Game theory is a framework that has been used to study crowdsourcing, but there are conflicting findings, which suggest that more research is needed, and some are explained below.

First, game theory suggests that individuals are motivated by the incentives they receive. In crowdsourcing, incentives could be monetary rewards or social recognition. However, different studies have found varying effectiveness of incentives depending on factors such as task complexity and competitiveness. Second, game theory suggests that group dynamics can influence individual behavior. In crowdsourcing, group dynamics could be influenced by factors such as collaboration or competition among contributors. However, different studies have found varying effects of group dynamics depending on the task and characteristics of the contributors. Third, game theory proposes that trust can be a powerful motivator for individuals to cooperate. In crowdsourcing, trust could be influenced by factors such as platform reputation or the quality of interactions among contributors. However, different studies have found varying effects of trust depending on the task and characteristics of the contributors. Lastly, game theory suggests that individual differences in cognitive processes and motivation can influence participation and outcomes. In crowdsourcing, individual differences could be related to factors such as personality traits or previous platform experience. However, it is not well understood that to what extent individual differences predict participation and success in crowdsourcing.

These conflicting findings suggest that further research is needed to understand how game theory can be applied to the study of crowdsourcing. Future studies may need to explore how incentives, group dynamics, trust, and individual differences interact to influence participation and outcomes in different types of crowdsourcing tasks.

The findings in the application of gamification on crowdsourcing warrant further research, and some are as follows:

First, gamification is believed to motivate individuals to participate in crowdsourcing activities by making them more enjoyable and satisfying. However, conflicting findings suggest

that the effect of gamification on motivation may depend on the type of game elements used, the context of the task, and the characteristics of the participants. Second, gamification is also believed to increase engagement by making crowdsourcing tasks more immersive and interactive. However, conflicting findings suggest that the effect of gamification on engagement may vary depending on the complexity of the task, the level of competition among participants, and the type of rewards offered. Third, gamification is expected to improve performance by increasing participation and quality of contributions. However, conflicting findings suggest that the effect of gamification on performance may depend on the type of feedback provided, the difficulty of the task, and the type of rewards offered. Lastly, while many studies have reported the positive effects of gamification on crowdsourcing, the generalizability of these findings to different contexts and populations is still unclear. Further research is needed to understand how gamification can be applied effectively to different types of crowdsourcing tasks and how it can motivate individuals with diverse backgrounds and preferences.

Therefore, more research is needed to better understand the impact of gamification on motivation, engagement, performance, and generalizability in the context of crowdsourcing. Such research should consider factors such as the task complexity, the type of game elements used, the characteristics of the participants, and the feedback provided to participants.

EVT provides insight into the cognitive processes and decision-making behind participation in crowdsourcing. The findings suggest further research is necessary, and some of these findings are proposed as follows:

First, EVT proposes that individuals' motivation and engagement are influenced by the value they place on a task. In crowdsourcing, this could be determined by factors such as the perceived relevance or importance of the task. However, some studies have found that task value may not always predict participation or engagement. Second, EVT suggests that individuals' belief in their ability to complete a task (i.e., expectancy) is a key predictor of motivation and engagement. However, the impact of expectancy on participation in crowdsourcing may depend on factors such as task complexity and perceived difficulty. Third, EVT proposes that social norms or the beliefs and behaviors of others in a social group can influence an individuals' motivation and engagement. In crowdsourcing, this could be influenced by factors such as the level of competition or collaboration among contributors. However, the impact of social norms on participation and engagement in crowdsourcing is not well understood. Lastly, EVT suggests that individual differences in cognitive processes and motivation can influence participation and engagement. However, it is unclear that to what extent individual differences predict participation and success in crowdsourcing.

These conflicting findings suggest that further research is needed to understand how EVT can be applied to the study of crowdsourcing. Future studies may need to explore how task value, expectancy, social norms, and individual differences interact with motivational factors to influence participation and success in crowdsourcing.

Various findings have been observed in the application of behavior change theory in crowdsourcing, indicating the need for further research in this area. Some of these findings include:

First, behavior change theory suggests that motivation is influenced by different factors such as incentives, social norms, and personal values. However, conflicting findings suggest that the effectiveness of these factors in motivating participants can vary

depending on the complexity of the task, the type of behavior change targeted, and the characteristics of the participants. Second, behavior change theory stresses the importance of feedback in shaping behavior. In crowdsourcing, feedback can be provided through performance metrics or social comparison. However, conflicting findings suggest that the effectiveness of feedback may depend on the type, frequency, and timing of the feedback provided. Third, behavior change theory highlights the role of social influence in shaping behavior. In crowdsourcing, social influence can be exerted through peer pressure, social comparison, or social support. However, conflicting findings suggest that the effectiveness of social influence in driving behavior change may depend on the social context, the type of behavior change targeted, and the characteristics of the participants. Lastly, behavior change theory emphasizes the need for sustainable behavior change. In crowdsourcing, sustainability can be achieved through strategies such as goal setting, self-monitoring, and reinforcement. However, conflicting findings suggest that the effectiveness of these strategies may vary depending on the duration of the intervention, the type of behavior change targeted, and the characteristics of the participants.

Several findings in the application of incentive theory in crowdsourcing require further research, and some are as follows:

First, incentive theory suggests that monetary rewards are effective in motivating individuals to perform tasks. However, some conflicting findings suggest that the effectiveness of monetary incentives in crowdsourcing may depend on the type of task, the level of effort required, and the characteristics of the participants. Second, incentive theory also suggests that non-monetary rewards such as recognition, feedback, and social incentives can be effective in motivating individuals. However, conflicting findings suggest that the effectiveness of non-monetary incentives in crowdsourcing may depend on the type of behavior change targeted, the level of intrinsic motivation of the participants, and the social context in which the task is performed. Third, incentive theory suggests that the design of the crowdsourcing platform can affect the motivation of the participants. For example, offering a leaderboard or a progress bar could increase motivation. However, conflicting findings suggest that the effectiveness of such design features may depend on the task complexity, the type of behavior change targeted, and the characteristics of the participants. Lastly, incentive theory assumes that individuals are motivated by rewards, but conflicting findings suggest that individual differences can play a role in determining the effectiveness of incentives. For example, some participants may be more motivated by monetary rewards, while others may be more motivated by non-monetary rewards.

## 5.6 Threats to validity

Our validity faces both internal and external threats. Internal threats concern the results we presented in our research questions. Although we identified 4654 results through a literature search, only about 15% (673) of them were selected due to inadequate or concealed reporting of theories. As a result, the rejected literature could not be examined. Additionally, there is a risk of misidentifying original and continuum theories and their implementation in the 91 selected papers. We included these papers because they all employed the theories of motivation, but it is possible that our analysis of these theories was incomplete and may contain inconsistencies.

Another threat is related to kurtosis and identification of fat-tailed theories which may affect the skewness in the long tail,

which may be due to ignored or missing literature based on the inclusion and limited database selection. However, we believe the large occurrences of prevalent theories identified during the study justify their implementation as popular and successful based on their obvious occurrences, and such limitations do not engender confidence.

Lastly, the external validity of this review pertains to the selected literature. Despite using a systematically explicit approach in our review, there is a possibility that some relevant studies were inadvertently left out. Additionally, the selected literature predominantly represented work from 24 countries, with a noticeable concentration of research coming from the USA and China. As a result, the review may not necessarily present a truly global perspective.

## 6 Conclusion

This study has identified the successful motivational theories which are practiced by the researchers and exponentially increase the application of such theories in a crowdsourcing environment over the decade. The philosophy of successful theory suggests that it should be validated and verified by research. Our study presents the theories which are validated and verified and have gained popularity among researchers based on their positive crowd engagement and enhanced motivational results. We examined Anderson's long tail theory<sup>[147]</sup> in selected studies and found that many nascent theories gradually taper off, indicating a heavy-tailed distribution. The Pareto principle is used to identify theories with large occurrences, and the study shows that the most frequently occurring 20% of theories represent less than half of occurrences, indicating that the least frequently occurring 80% of theories are on the horizon and may get popular over time, which is a feature of the power law and characterizes the popular and nascent theories. The study suggests that researchers should focus on the less popular theories to overcome gaps in motivation associated with a reduced number of popular theories. An SWOT analysis can help researchers enhance the popularity of less popular theories. The tail risk suggests that there is a small probability that the interest of the researcher will move beyond popular theories due to the skewed and fat-tailed distribution of theories.

Our study has identified 91 relevant selective studies and 35 motivational theories of which 6 theories, namely SDT, EVT, game theory, gamification, behavior change theory, and incentive theory, whose effect is 80%, are considered popular, whereas the rest (long tail) are considered as new and nascent theories of motivation. We have also analyzed the risk using an SWOT associated with the new and nascent theories with fewer occurrences over a long tail, which identified the internal and external factors that need consideration while their implementation.

The study looked into the nations of origin and discovered that the majority of the research is done by scholars from China and the USA. We deduce from the study that a motivation strategy that allows the researchers to practice significant theories which are 80%, to overcome the gaps of motivation associated with a reduced number of popular theories, will guide governments, organizations, industry, academics, and others to improve and direction for future solutions.

Similarly, the research concludes with some interesting facts about the implementation of the theories in the past and how they can influence the crowd worker in crowdsourcing. Recent research findings on motivational theories in crowdsourcing are

focused on the top six theories, which include SDT, game theory, gamification, EVT, behavioral change theory, and incentive theory. The findings highlight the key features related to each of these theories and their applications in crowdsourcing. For instance, providing individuals with autonomy in crowdsourcing tasks can boost their motivation and engagement. Gamification can also increase motivation and engagement, leading to better performance and higher-quality work. EVT can explain the relationship between individuals' actions and the value they perceive in performing a task. Behavioral change theory can be used to design interventions to promote behavior change. Finally, incentive theory explains how rewards and punishments can motivate or demotivate behavior and emphasizes the importance of flexible incentives to improve crowdsourced participation.

## Dates

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