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RESEARCH PAPER

Participation in the Crowdsourcing of Marketing Activities Using a Dynamic Approach

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Abstract
Despite the fact that the concept of crowdsourcing is extensively employed by scholars, the dynamic interactions between crowd and crowdsourcer have received scant attention. This article aims to explore the successful drivers of crowdsourcing platforms by considering the role of both main sides, namely meaning crowd and crowdsourcer. The current study develops a marketing-crowdsourcing model and explores the dynamic association between the identifying variables. In the proposed model, different scenarios were considered to explore the effective mechanism for reinforcing crowd/ crowdsourcer to participate in the crowdsourcing of marketing activities. Using system dynamics relationships, casual loops, and stock and flow diagrams, this study proposes a framework for the crowdsourcing of marketing activities.

Keywords: marketing-crowdsourcing framework, system dynamics, crowd participation, crowdsourcing.

1. Introduction

The recent development in technology leads to more online participation of users, with companies gaining more opportunities to get their customers more connected and engaged in company-related activities (Djelassi & Decoopman, 2013; Mahavarpour et al., 2019). These technological developments alongside expanded collaborative tools such as platforms and social networks have accelerated and facilitated the use of open innovation strategies such as crowdsourcing (Mladenow et al., 2014). Therefore, the disappearance of organization's boundaries and the change of the value creation process from centralized to decentralized and closed to open, many companies have developed crowdsourcing platforms to utilize the crowd potential in the business challenges (Yin et al., 2020). Crowdsourcing platforms provide this opportunity for crowdsourcer to outsource a job or a task, traditionally performed by an internal employee, to a largely undefined group of people in the form of an open call (Howe, 2006).

With the growing interest in crowdsourcing, academic researchers have tried to develop conceptual and theoretical approaches to crowdsourcing (e.g., de Mattos et al., 2018; Ruiz et al., 2020; Zhu et al., 2019). In this stream, most studies discuss the role of motivation in crowdsourcing platforms. For example, Zheng et al. (2011) use the theory of extrinsic and intrinsic motivation and the theory of job design to examine task design, motivation, and

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participation in crowdsourcing contests. In addition, Soliman and Tuunainen (2015) investigated solver's motivations to participate in various crowdsourcing initiatives. Other studies have focused on crowdsourcing frameworks and models to guide organizations to perform successful crowdsourcing (e.g., Ghezzi et al., 2018; Thuan, 2019). Moreover, in the business and marketing domain, crowdsourcing has been frequently studied from many different perspectives such as branding (Bal et al., 2017; Kashive et al., 2020), market and consumer research (Afuah & Tucci, 2012; Goodman & Paolacci, 2017), NPD (Allen et al., 2018; Zahay et al., 2018), business model (Bagheri et al., 2020; Kohler, 2015), CRM and customer loyalty (Popescu & State, 2015; Schulten & Schaefer, 2015), and idea innovation (Acar, 2018; Mack & Landau, 2020).

While each paper and study has its own individual contributions, the overall contribution of these studies in the marketing field is how crowdsourcing is a helpful technique (Brown, 2019). Nonetheless, in tandem with using crowdsourcing in marketing, this has driven researchers to investigate more deeply the phenomenon of crowdsourcing as a marketing innovation. Moreover, Tiago and Veríssimo (2014) stated that firms require reconsidering their digital marketing, specifically concerning participation, and called for more study in this area. Furthermore, they expressed that much of the research has focused on crowdsourcing from the user's perspective rather than from the firm's perspective. Crowdsourcing strategies should be aimed at organizing a framework or model that offers an explicit and attractive value proposition to both sides involved, namely crowd and crowdssourcer (Vignieri, 2020). Therefore, the challenge for successful crowdsourcing is to develop a model that in addition to delivering value to the crowd empowers crowdourcer in capturing advantages from the creativity of a large number of users. Besides, the prior academic research studies in which scholars make a considerable effort to conceptualize, clarify, and elaborate the conceptual and theoretical approaches to crowdsourcing have mainly employed qualitative and empirical methods from a static point of view and ignored the effect of dynamic interactions between crowd and crowdsourcer.

With these considerations in mind, to overcome the inconsideration of the role of the crowd and crowdsourcer simultaneously in crowdsourcing, and to address the problems discussed above related to the static perspective of previous studies, this study aimed to contribute to the crowdsourcing domain in various ways. By conducting a system dynamic analysis and combining qualitative and quantitative analyses, this article set out to explore the drivers of the success of a crowdsourcing platform. It also aimed to understand which factors allow crowdsourcer and crowd to participate in crowdsourcing of marketing activities and receive benefits from these dynamic open innovation strategies. To this end, this article made an effort to achieve the following goals:

(1) Better understanding the factors influencing crowd and crowdsourcer participation in crowdsourcing of marketing activities and the internal interactions between them as well as the system complexity of these factors as system components;

(2) Proposing a novel dynamics-based framework for crowdsourcing of marketing activities by the consideration of the role of crowd and crowdsourcer simultaneously; and

(3) Considering different scenarios and comparing their results to explore the effective mechanism for reinforcing crowd/ crowdsourcer to participate in the crowdsourcing of marketing activities.

To achieve these goals, we first provide a brief description of the crowdsourcing concept, its types, its application in marketing, and factors influencing it. Afterward, this paper proposes a conceptual model for crowdsourcing of marketing activity based on a literature review and interviews. Then, the causal loop of the model-rate-state diagrams is introduced and is then validated. Finally, the study results will be reviewed and future research

recommendations will be proposed and provide theoretical and practical implications for crowdsourcing of marketing activities.

2. Literature Review

2.1. Crowdsourcing

The term "crowdsourcing" was coined in 2006 by Jeff Howe and has been defined as "the act of outsourcing a task to a 'crowd,' rather than to a designated agent (an organization, informal or formal team, or individual), in the form of an open call" (Afuah & Tucci, 2012, p. 355). Regarding this definition, crowdsourcing systems are generally composed of three main components: 1) an initiator (crowdsourcer), directly benefiting from a crowd input; 2) a crowd, where individuals or members of a community structure the crowd and respond to suggested tasks; and finally, 3) intermediate platform that allows connections between an initiator and a crowd (Estellés-arolas & González-ladrón-de-guevara, 2012). On the other hand, the use of crowdsourcing is defined as the intersection point of these three elements (Durmuş, 2020).

Crowdsourcing can cover so many activities such as idea creation, crowdfunding, crowd-voting, decision making, micro-tasks, crowd solutions, and user-generated content; nevertheless, defining its concept comprehensively has proved not to be easy (Brown, 2019). Therefore, in different studies, depending on the purpose of the research, this concept has been described from different perspectives such as a strategy (Pisano, 2015), a business model (Walter & Back, 2010), a method (Llorente & Morant, 2015), a technique (Mitry et al., 2013), and a process (Thuan, 2019a). For this research, crowdsourcing is defined as a process and scrutinized based on an input-process-output framework. Since this framework precisely identifies prerequisites, key components, and process outputs of crowdsourcing, it has been widely applied to management studies as a basic model (Ghezzi et al., 2018).

In the following, we explore different parts of this framework and explain effective factors for each section.

2.1.1. Input of Crowdsourcing Framework

The main input of crowdsourcing is the problem or task that the crowdsourcer decides to be solved by the crowd (Ghezzi et al., 2018). Therefore, the important prerequisite in crowdsourcing is to make a decision to crowdsource. In particular, it is a vital decision directly linking to whether an organization will open or close its boundaries to a crowd (Schenk et al., 2019). A failed crowdsourcing project affects the organization's reputation. Thus, decision-making plays a key role in crowdsourcing (Thuan et al., 2016). According to Thuan et al. (2016), nine factors influence organization decision-making to crowdsource. These factors include (1) the task nature; (2) the accessibility of a crowd to carry out the task; (3) the risks of crowd engagement; (4) the infrastructure of crowdsourcing; (5) the experience and knowledge to manage a crowdsourcing activity in organization; (6) the budget required for crowdsourcing implementation; (7) the lack of internal human resources to perform the task; (8) the lack of an internal commitment; and (9) the organization's resistance to the adoption of new technologies. Moreover, Rouse (2010) defines input factors influencing the decision to crowdsource as costs, coordination, and risks. Cost savings refer to the affordability of a crowdsourcing strategy for organizations, compared to other alternatives for achieving innovative ideas (Muhdi et al., 2011). Next, according to Muhdi et al. (2011), expertise and experience to coordinate activities is the key to entering into crowdsourcing, as

well. Finally, according to the literature, risk is defined as the uncertainties that threaten the decision to crowdsource (Liu et al., 2016; Liu & Wang, 2014), and three main dimensions of risk have been identified based on socio-technical theory as crowdsourcer risk, crowd risk, and relationship risk (Liu et al., 2016).

2.1.2. The Process Design of Crowdsourcing Framework

To achieve a specific goal of successful crowdsourcing, the next step is the process design (Hevner & Chatterjee, 2010). Ghezzi et al. (2018) describe a fourth-step process in crowdsourcing, which encompasses event management, crowd management, applied technology, and management knowledge. In addition, Kittur et al. (2013) addressed 12 conceptual activities in the process design, including a task characteristic, a task assignment, a workflow design, a collaboration, a quality control, a real-time response, a hierarchy, a guiding-crowd artificial intelligence, platforms, reputations, guiding-crowd artificial intelligence, and motivations.

Several studies (e.g., Afuah & Tucci, 2012; Martinez, 2017) showed that task characteristics are the main aspect in the process design as it impacts the user's participation in crowdsourcing competitions. In general, the task should easily attract users and be well-defined for them, since the complexity of the task may result in confusions of the users' ongoing participations in crowdsourcing competitions (Blohm et al., 2018). Other studies have supported crowd management as another important factor in process design. In detail, crowd management refers to how organizations manage crowd members to perform specific duties (Zahay et al., 2018). Moreover, crowd management is categorized into two main aspects, including profiling a crowd and assigning tasks. This means that organizations evaluate the required capacity of crowd members for a task conduction (Allahbakhsh et al., 2013; Kittur et al., 2013) based on expertise and skills required for the participants to complete a task (Pénin et al., 2011).

Within the scope of process design, the motivation concept has been given special consideration by scholars. Motivational factors in crowdsourcing have applied different theoretical research including the motivation theory (e.g., Füller et al., 2019; Soliman & Tuunainen, 2015), and the self-determination theory (e.g., Wu & Gong, 2021). In particular, the majority of these studies have used these motivation theories to examine internal and external aspects for participation in crowdsourcing competitions (Zheng et al., 2011). Internal motivation refers to undertaking a task because it is inherently interesting or enjoyable for individuals. In contrast, external motivation refers to the psychological impetus of performing an act to achieve externally promised rewards (Ryan & Deci, 2000; Wu & Gong, 2021). According to Kaufmann et al. (2011), pleasure-based and community-based motivations are related to internal motivation and, immediate rewards, delayed payoff, and social motivation are three components of external motivation. Furthermore, Wu and Gong (2021) describe four types of extrinsic motivations in the online crowdsourcing systems: reputation-based reward, monetary reward, feedback-based reward, and recognition-based reward.

Finally, the collective intelligence approach causes some issues such as the loss of quality control (Palacios et al., 2016), whereas crowdsourcing completely depends on the voluntary behaviors of the crowd. Thus, it is central to ensure the quality of the design process.

2.1.3. Output of Crowdsourcing Framework

The last part of this framework is the output, dealing with the concepts of collective participation, sustainable participation, number of tasks completed, crowd engagement, and

more (Ghezzi et al., 2018). In terms of crowdsourcing results, many scholars have explained that the success of crowdsourcing depends on continuous participation and the quality of individual participation (e.g., Wu & Gong, 2021; Wang & Wang; 2019; Xiao & Ke, 2019). Grounded in the parallel-path effect, the more users participate in crowdsourcing competitions, the more benefits crowdsourcer obtains (Boudreau et al., 2011). Furthermore, Wu and Gong (2021) define two basic types of sustained participation in crowdsourcing systems, namely continuous participation intention (CPI) and increased participation intention (IPI). CPI is described as the extent of crowd willingness to continue participation in a crowdsourcing activity. IPI refers to crowd decisions on the participation rate regarding time and effort in the activity (Wu & Gong, 2021). In conclusion, the identification of procedures to improve crowd participation (both CPI and IPI) in crowdsourcing is an important issue in crowdsourcing research that deserves academic attention.

2.2. Crowdsourcing and Marketing

Since the digitalization of business has grown, the application of crowdsourcing in marketing activities has also become more relevant for marketers (Rashid, 2017). Consequently, after Whitla (2009), research that extends crowdsourcing into the area of marketing has become increasingly relevant (Brown, 2019). This scholar proposes the domains of crowdsourcing utilization in marketing including new product development, advertising, and marketing research (Whitla, 2009). As well, Dawson and Bynghall (2012) defined the marketing domain for crowdsourcing into idea generation, content creation, customer insights, product development, customer advocacy, customer engagement, and pricing. Given the growth of the topic, Gatautis and Vitkauskaite (2014) summarize crowdsourcing opportunities of marketing activities as communication management, content marketing, distribution management, product management, and marketing research.

Several researchers have looked at crowdsourcing and product development. In product development, companies use the potential and capacity of information and communication technology (ICT) to receive user suggestions for product development. Companies can also identify customer needs for new products in this way (Whitla, 2009). Moreover, Zahay et al. (2018) explained that one way organizations have sought to improve the new product development (NPD) process is to leverage the wisdom of crowds by reaching out to different communities for product and service ideas.

Whitla (2009) also distinguishes between two uses of crowdsourcing in advertising activities: (1) search for professionals who can perform advertising tasks, and (2) performing relatively difficult tasks that the company neither has enough time to hire people for nor the desired human resources within the organization to do the job. For example, the advertising campaign designed for Audi in Australia asked their users what “Land of Quattro” meant to them. The specified task for the crowd in this campaign was to create a TV commercial for the company. This event had over 150,000 views, and 2,275 television commercials were produced. In a similar campaign, Kleenex invited crowd to design stylish, special, and creative boxes. Nearly 200 people registered for the event and submitted their designs, and the winning design was selected in July 2013.

In terms of marketing research, crowdsourcing is an opportunity to gain a larger group of consumers. Considering that motivational elements or games are essential to create crowd interest and participation (Whitla, 2009), Alberts et al. (2010) examined the effects of crowdsourcing on marketing research and analyzed an online English agency (BrainJuicer) that used crowdsourcing principles to forecast the success rate of products sales and

innovative ideas. From their point of view, crowdsourcing has turned into an important rival for research companies.

Furthermore, there has been significant research looking at crowdsourcing and other marketing domains such as brand development (e.g., Bal et al., 2017; Kashive et al., 2020), business model (e.g., Bagheri et al., 2020; Kohler, 2015), CRM and customer loyalty (e.g., Popescu & State, 2015; Schulten & Schaefer, 2015), idea innovation (Acar, 2018; Mack & Landau, 2020), promotion and distribution (e.g., Howe, 2008), and new market development (Kleemann et al., 2008). Finally, crowdsourcing technologies and techniques are creating marketing opportunities for the organization as it enables them to gain greater customer insight and leverage the wisdom of crowds. Therefore, it is necessary to highlight the evolution of crowdsourcing and the mechanism of consumer participation in marketing activities.

2.3. System Dynamics and Conceptual Model

Previous academic studies on crowdsourcing are mainly employed qualitative and empirical methods from a static perspective. In this regard, most scholars used the structural equation modeling (PLS-SEM) method (e.g., Martinez, 2017; Wang & Wang, 2019; Wu & Gong, 2021; Xiao & Ke, 2019), exploratory factor analysis (EFA) (e.g., Lorenzo-Romero & Constantinides, 2019) or experimental method (e.g., Thuan, 2019), and so on. But these platforms compete in a dynamic market where the cross-side network effects are crucial to succeed in today's dynamic and turbulent business environment (Vignieri, 2020). To respond to this need, we adopted a system dynamics approach that can structure the main business processes of this marketspace, exploring the driver of the success in crowdsourcing, and contribute to the literature on crowdsourcing.

Professor Jay Forrester introduced system dynamics during the mid-1950s. This method is helpful for investigating complex system characteristics and time-varying dynamic user behavior. System dynamics takes into account the whole situation. Moreover, system dynamics combines quantitative research and qualitative analysis to simulate the system influence mechanism and operation mode (Kunc et al., 2018).

To realize the system dynamics approach and the modeling process, it is important to notice two common graphical representations, namely causal loop diagrams and stock-flow diagrams. A causal loop diagram reveals the structure of a system and is a simple map of a system with all its constituent components and their interactions. Moreover, to carry out a more detailed quantitative analysis, a causal loop diagram is converted to a stock and flow diagram (Joshi et al., 2020). Furthermore, system dynamic includes a set of variables, equations, and rules that define the given issue and is extended from a wide spectrum of real data (Vecchio et al., 2019). In addition, in situations where the business environment is highly complex or interdependent and accelerates frequently – thereby causing uncertainty – organizations use Scenario-driven planning to create forecasts and anticipate the future (Georgantzas, 2020).

Staring from the discussed background, the conceptual model of this study was designed based on the process model of crowdsourcing by Thuan et al. (2017). As shown in Figure 1, both the involved sides and their interactions have been considered in the conceptual model. Both sides must be capturing value from crowdsourcing. In conclusion, based on value analysis, crowdsourcer decides to crowdsource, and the crowd decides to participate. For instance, crowdsourcing systems offer to crowdsourcer the probability to find an effective solution to their problems, whereas to crowd the suitable returns against their mental and scientific work (Vignieri, 2020). According to Thuan et al. (2017), task design and

clarification, crowd management, quality control, and crowd incentive are the main aspects of the process design in this study as well.

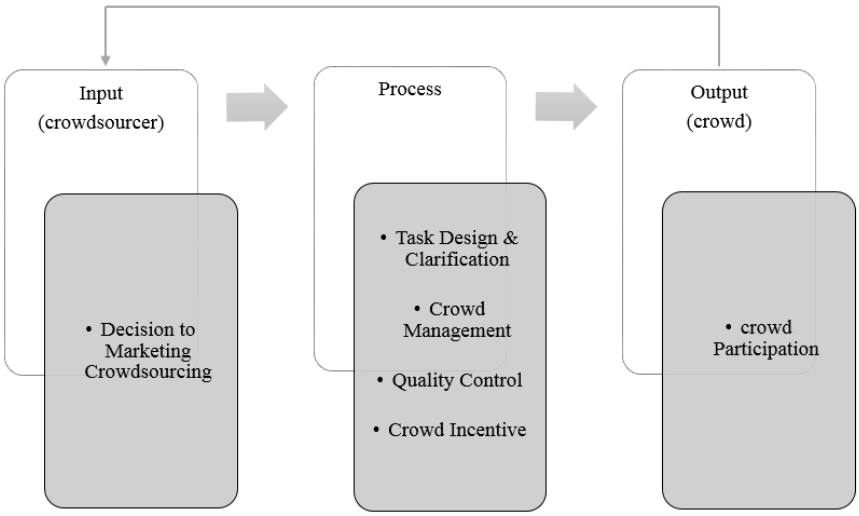


Figure 1. Conceptual Model of Research

3. Research Method

As mentioned in the previous sections, this study adopted the system dynamics modeling, which is a feedback-based system. Therefore, the analysis will be accomplished by conforming to system dynamics standards. First, a causal loop diagram proposes a conceptualization of crowdsourcing in the marketing unit of the Motosel (case of this study). Second, the stock-and-flow diagram of the model extends the formulation of Motosel marketing processes. Third, system's responses to alternative policies are explained by two simulations reproducing. Fourth, one policy will be suggested to improve model performance. Lastly, drivers of the success of crowdsourcing systems will be interpreted by considering the dynamic role of crowd and crowdsourcer.

In this study, the Motosel Industrial Group was selected as the study case. This company was established in 1987 as a manufacturer of lubricants and petrochemical products. Todays, Motosel consists of a large network of 11 global offices and 5 manufacturing facilities with over 1000 employees worldwide (Motosel Industrial Group, 2019). Since the prerequisite for studying system dynamics is the existence of historical trends related to the subject (Sterman, 2002), and also the goal of this study was to analyze crowdsourcing for the marketing activities in organizations, this organization – with more than three years of experience in crowdsourcing competitions in marketing activities and its extended network worldwide – was considered to be an appropriate option for this study. The case study serves as a scheme to model the marketing processes of a successful crowdsourcing case (Vignieri, 2020). Thus, the aim of this study was not to analyze the then existing or future problems of the Motosel, but rather to explore which factors would let a crowdsourcing platform extend and get to a large creative crowd of users.

There are five main steps in the system dynamics modeling process as follows: (1) problem articulation, (2) formulating a dynamic hypothesis, (3) formulating a simulation model, (4) testing the model, and (5) policy design and evaluation (Sterman, 2002). For this study, the first step was explained in the previous sections. Here we describe how we accomplish the other phases.

3.1. Formulating a Dynamic Hypothesis

The dynamics hypothesis is a potential explanation of how the structure is causing observed behavior (Oliva, 1996). In this step, literature review and in-person interviews with the reference group were used to determine variables interactions and formulate the model.

The reference group consists of selected experts who discuss a specific topic and help acquire data (Catterall & Maclaran, 1997). In system dynamics, reference groups are typically used for modeling approaches, and the role of the investigator is to conduct, record, lead and analyze (Luna-Reyes & Andersen, 2003). In this study, eight industry experts with more than 5 years of work experience in Motosel by the history of attending in previous crowdsourcing competitions were invited to participate in the reference group meetings. Therefore, the reference group consisted of five managers, two presidents, and one CEO. In addition, four university professors of marketing and strategy were present in these meetings.

In reference group meetings, experts identified each of the factors affecting conceptual model variables (Figure 1). To this end, they were asked to answer the following questions: (1) What activities or actions increase or decrease the level of the variables related to conceptual framework? (2) How do you measure these variables? Results of this section are presented in Table 1. Moreover, the previous literature that supports each factor is also highlighted.

Table 1. Results of Reference Group Meetings Related to Effective Factors on Crowdsourcing of Marketing Activities

Row	Variable	Activities related to the variable level increase	Activities related to the variable level decrease
1	Decision to marketing crowdsourcing (Thuan et al., 2018)	- possibility to partition task (Blohm et al., 2018) -Ease of task delineation (Piazza et al., 2019) -Number of the crowd (Prpić et al., 2015) -Diversity of the crowd (Bonabeau, 2009) -Crowd knowledge (Martinez, 2017) -Crowdsourcing expertise in organization (Thuan et al., 2018) -Level of risk acceptance in organization (Thuan et al., 2018) -Level of technology acceptance in organization (Ghezzi et al., 2018) -Platform availability (de Mattos et al., 2018)	-Level of confidential information (Thuan et al., 2018) -Need to training or interaction (Prpić et al., 2015) -Employee knowledge (Thuan et al., 2018) -Crowdsourcing budget (Schenk et al, 2019)
22	Task design and clarification (Afuah & Tucci, 2012)	-Description of qualification requirement (Ghezzi et al., 2018)	-Level of task complexity (Zheng et al., 2011)
33	Crowd management (Ghezzi et al., 2018)	-Crowd performance (Hoornaert et al., 2017) -Task assignment rate (Blohm et al., 2018)	-Sabotage of out-group users (Faullant & Dolfus, 2017)
44	Quality control (Thuan et al., 2018)	-Identifying crowd malicious behavior (Faullant & Dolfus, 2017) -Expert evaluation (Ghezzi et al., 2018)	-Negative social interaction (e.g., supportive likes, negative comments, …) (Faullant & Dolfus, 2017)
55	Crowd incentive (Zheng et al., 2011)	Intrinsic incentive (Wu & Gong, 2021) Extrinsic incentive (Wang & Wang, 2019)	-Negative reputation of system (Xiao & Ke, 2019)

In the next step, to validate the causal loops diagram that had been obtained from the focus group session, a simplified of causal loops diagram was extracted by computer simulation (by Vensim software). In the next session, the members of the reference group were asked to answer these questions: (1) Do you think the drawn causal loops are correct? (2) Is there a fundamental error in the causal loops? (3) Is the relationship of the variable correct?

Although the validity of the relations was confirmed based on the results of the reference group meetings, to increase the rigor and robustness of obtained results, Cohen's kappa test was also utilized. Cohen's kappa coefficient is a statistical measure of inter-rater agreement for qualitative items (Vieira et al., 2010). To this end, two experts in open innovation and marketing strategies were selected. The obtained value for Cohen's kappa coefficient was 0.837, suggesting a 'good agreement' between experts. In addition, variables disagreed by both experts were removed from the final model. These are the activity reduction variables in rows 3, 4, and 5 in Table 1. Finally, the causal loop diagram was developed (Figure 2).

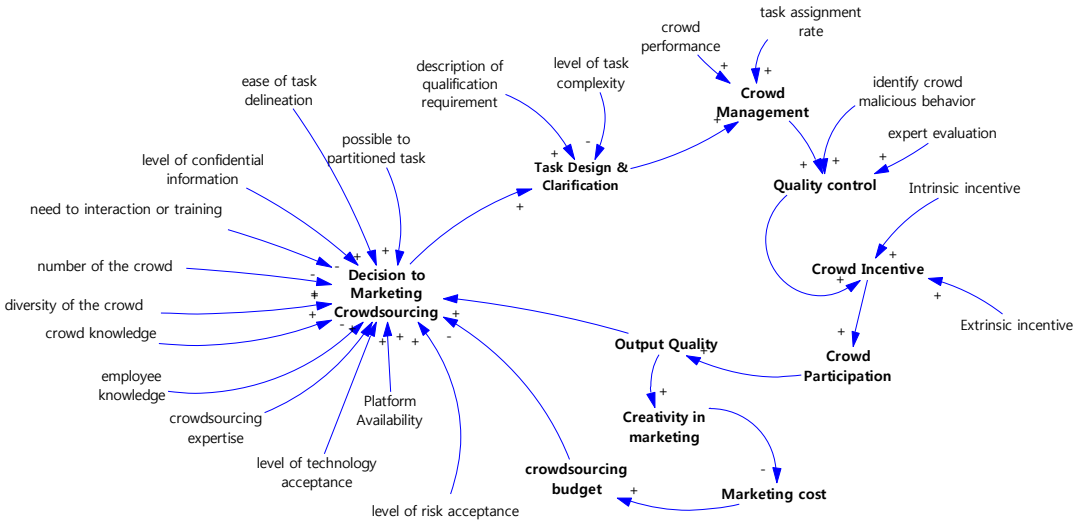


Figure 2. Causal Loop Diagram of Marketing Crowdsourcing

Causal loops are generally divided into two reinforcing and balancing loops. The reinforcing loops increase variable levels and balancing loops counteract the increase, stabilizing the variable after a certain period (Sterman, 2002). By analyzing the casual loops diagram, two reinforcing loops were identified (Figure 3). The developed casual loop diagram had no balancing loop.

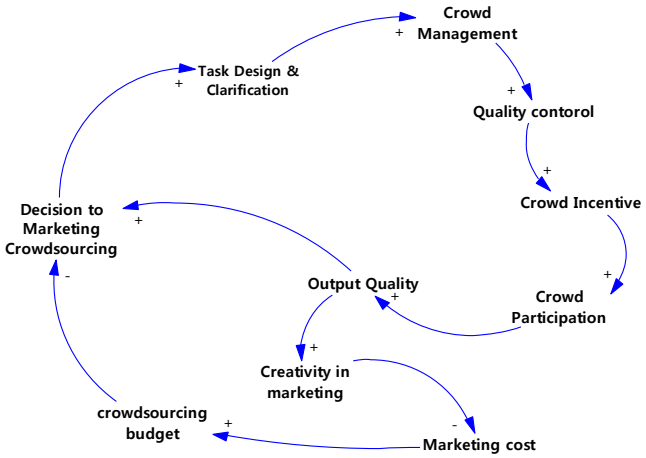


Figure 3. Reinforcing Loops Diagram of Marketing Crowdsourcing

Based on the obtained causal loops, the dynamic hypotheses of this study were determined as follows:

Assumption 1 (first reinforcing loop): Increasing the decision to marketing crowdsourcing increases the transparency and design of the marketing task for the crowd and strengthens the crowd management and quality control of the process. By increasing quality control and setting effective incentives, crowd incentives increase and additionally, participation in crowdsourcing elevates. As the crowd participation increases, the quality of the output increases, resulting in reinforcing the decision for marketing crowdsourcing.

Assumption 2 (second reinforcing loop): In this loop, after increasing crowd participation and output quality, creativity in marketing increases. Increased marketing creativity decreases marketing costs, which increases the crowdsourcing budget, and finally reinforces the decision for marketing crowdsourcing.

3.2. Formulating a Simulation Model

The causal loop diagrams are qualitative descriptions of systems; thus, that they cannot be used to simulate system dynamics over time. Therefore, we developed a stock and flow diagram to simulate crowdsourcing of marketing activities quantitatively. Stock and flow diagram includes flows that increase or decrease stocks as well as stocks that indicate accumulations of a system. Stocks and auxiliary variables control the flows, so stock can only change through its flows (Mai & Smith, 2018).

Stock and flow diagrams require parameter values to run simulations. These parameters entail the initial value for stocks at the beginning of the simulation, constants that are stored as auxiliary variables, and graphical functions that illustrate the influence of one variable on another. To achieve the goal of this step, after identifying the main influencing factors in the previous step, their effective mechanism was identified and formulated based on reference patterns and interviews with a reference group (see Appendix A).

In addition, two questionnaires were established to measure constant variables of the model. Questionnaire 1 was related to the crowdsourcer side of the model and measured constant variables of the model including the decision to marketing crowdsourcing. We distributed it among 10 managers who were involved in the decision-making of earlier crowdsourcing competitions in the study organization. The data was gathered using the face-to-face method, and a non-probability snowballing sampling was used as a distribution method to increase the sample size and to make sure that the sample included the most knowledgeable informants. In snowballing sampling, by asking initial respondents to propose others who could suggest further insights, we guaranteed that the targeted informants were selected (Helm, 2011).

In addition, questionnaire 2 was related to the crowd side of the model and was designed to measure constant variables of the model including task design and clarification, crowd management, quality control, and crowd incentive. The formulated scenarios for this section were examined via a sample of a crowd who had participated in the last crowdsourcing competition carried out by Motosel. The last crowdsourcing competition was related to the branding domain and had been run in January 2020 to enhance brand awareness. In the survey, in order to eliminate the potential bias in terms of the validity and generalizability of the scales, convenience sampling (namely, a non-random sampling technique) was used (Bryman & Bell, 2007). Convenience sampling is based on 1100 employing participants who participated in the last crowdsourcing competition. Thus, an online link of the questionnaire was sent to 1100 participating users. A total of 282 usable completed questionnaires were received. Table 2 is a summary of the demographic characteristics.

Table 2. Demographic Profile of the Sample Study (N=282)

Demographic characteristics		Frequency	Percent
Gender	Male	214	76%
	Female	68	24%
Age	21-30	135	48%
	31-40	110	395
	41-50	28	10%
	51-60	8	3%
Education	High school or equivalent	37	13%
	Bachelor's degree	161	57%
	Master's degree or higher	85	30%
Previous experience of crowdsourcing competitions	Less than 1 year	11	4%
	Between 1 and 2 years	14	5%
	Between 2 and 3 years	59	21%
	More than 3 years	197	70%

The measurements for the research constructs were based on the established scales from previous studies (Table1). Furthermore, questionnaires were assigned based on the 5-point Likert scale from 1 'strongly disagree' to 5 'strongly agree'. In order to assess item reliabilities, Cronbach's alpha index was calculated with SPSS software. The Cronbach's alpha for all characteristics was higher than 0.70, thus demonstrating adequate internal consistency (Hair, 2009; Mahavarpoor & Kazemi, 2017). The average score of 0.88 for questionnaire 1 and 0.86 for questionnaire 2 indicated the strong reliability of all constructs (see Appendix B).

At the end of this section, Figure 4 shows a stock and flow diagram of the crowdsourcing of marketing activities.

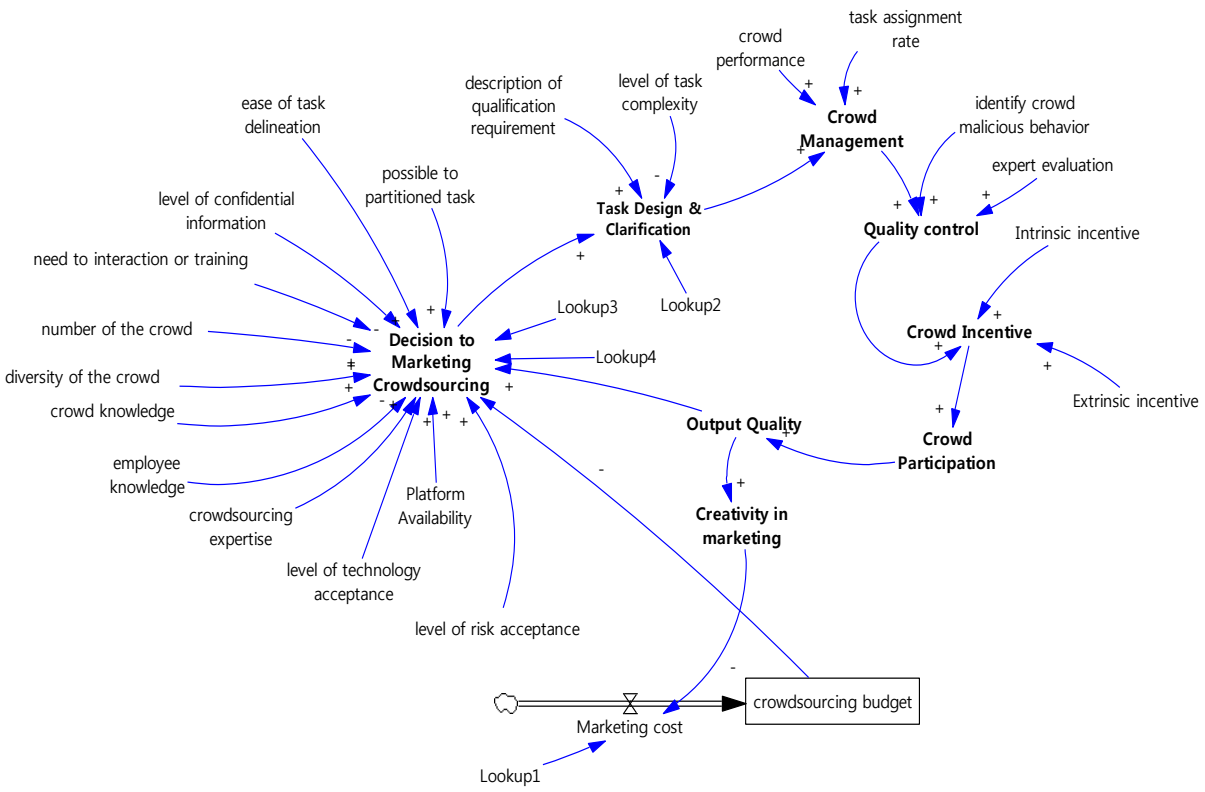


Figure 4. Flow and Stock Diagram of Marketing Crowdsourcing

3.3. Testing the Model

After obtaining the rate and flow diagram and before using the model for analysis, the validity of the model should be tested using one or more methods. In this study, after simulation, the validity of the proposed model was tested by the boundary adequacy and extreme conditions tests, which are described below. The results of their application to the research model will be presented in Appendix C.

Boundary adequacy test: The main question of the test is whether important concepts related to the problem are considered within the model. We are wondering whether model behavior changes dramatically after removing the boundary assumptions. Therefore, we examined the model behavior after eliminating some influential variables such as intrinsic and extrinsic incentives. Results indicated changes in the variable behavior, which confirms the importance of these factors (see Appendix C).

Extreme conditions test: The test examines whether the model behaves appropriately with its inputs in extreme conditions such as zero or infinite. In other words, in this test, the stability of the model is evaluated and displayed under extreme conditions. To evaluate this test, the influential variables such as intrinsic and extrinsic incentives were changed by one million units (in infinite boundary case) and the results are presented in Appendix C. It should be noted that figures clearly show appropriate results of the model for extreme conditions.

3.4. Policy Design and Evaluation

As previously discussed, the system dynamics methodology involves the development of computer simulation models, based on causal diagrams specific to each problem set. Here, we focused on two different scenarios relevant to our study goals: (1) scenarios that explain dynamic factors influencing crowd and crowdsourcer participation in crowdsourcing of marketing activities, and (2) those used to propose policy to improve model performance.

Figure 5 displays the current situation of model simulation by Vensim software. As Figure 5 illustrates, results indicated an increase in marketing creativity as well as a reduction in the costs of this sector as a consequence of the organization's decision to crowdsource.

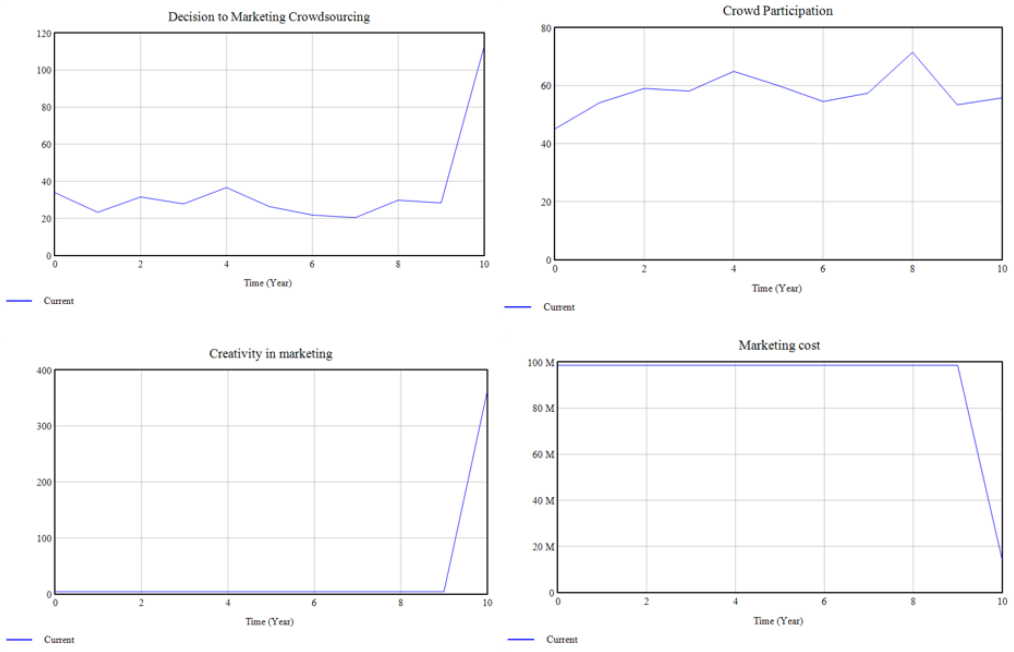


Figure 5. Current Situation of Model Simulation

The result of the model simulation and the scenarios are presented in the next section.

4. Findings

This section was split into two parts to simplify the description of the scenario and model simulation: crowd section and crowdsourcer section.

4.1. Crowd Section

This sector intended to simulate crowd participation due to process parameters' growth in the model. This scenario simulated to answer the research question regarding exploring the effective mechanism for enhancing crowd participation in crowdsourcing. According to the conceptual model, crowd participation as the dependent variable is affected by four mediator variables: task design and clarification, crowd management, quality control, and crowd incentive. Based on its initial value, the development trend of the crowd participation was simulated by increasing the four mediator variables by 50%. The results are shown in Figure 6.

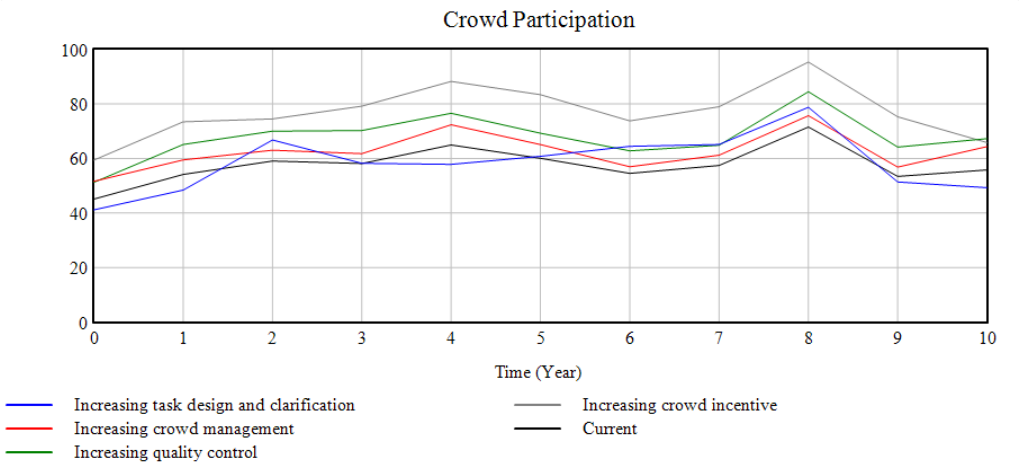


Figure 6. Impact of Increasing the Four Mediator Variables on Crowd Participation

As seen in Figure 6, with an increase in mediator variables level, crowd participation also increased. Nevertheless, the impact of crowd incentive and quality control on crowd participation was more than two others variables. Moreover, the impact of crowd management on crowd participation was clearer than task design and clarification.

It should be noted that in the system dynamics model, improvement initiatives or policy changes for any performance change can be implemented (Alefari et al., 2020). Given that the continuity of crowd participation is one of the influential factors in improving the performance of crowdsourcing systems, we can also consider crowd expectation and add it to the crowdsourcing dynamic model. In terms of reuse intention, previous studies have proved that the expectation-confirmation model has long been a useful framework. Notably, the crowd is initially motivated by incentive factors to present their ideas or solutions in crowdsourcing. However, the initial expectation of the crowd can change or reshape with the first experience to form a perception that essentially determines the future intention of the crowd (Wang & Wang, 2019). Thus, in order to propose a good model, we improved the model and added variables related to expectation-confirmation frameworks to our stock and rate diagram (Figure 7), and examined its impact on crowd participation (Figure 8).

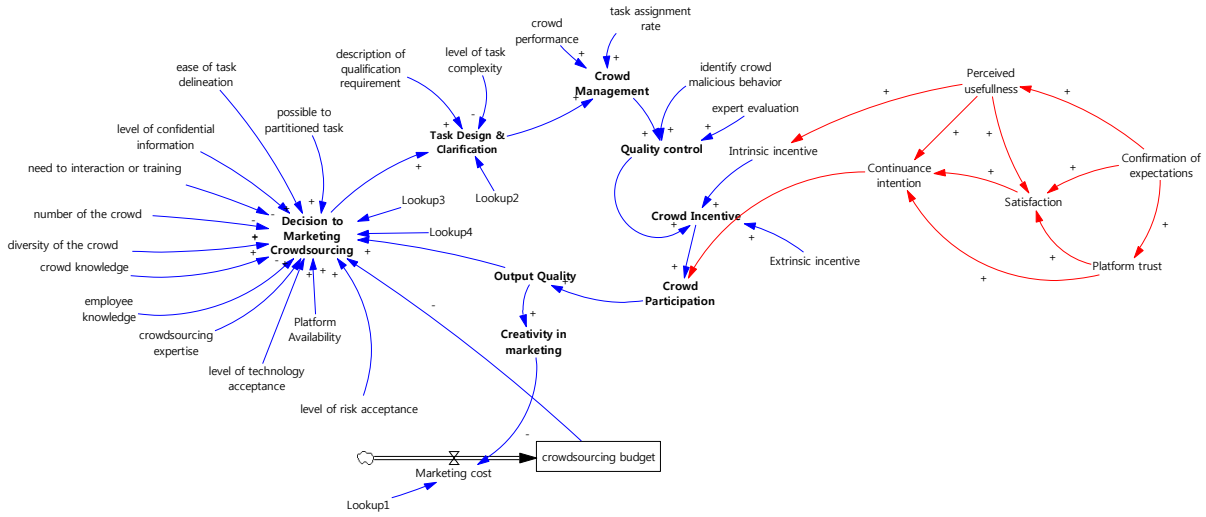
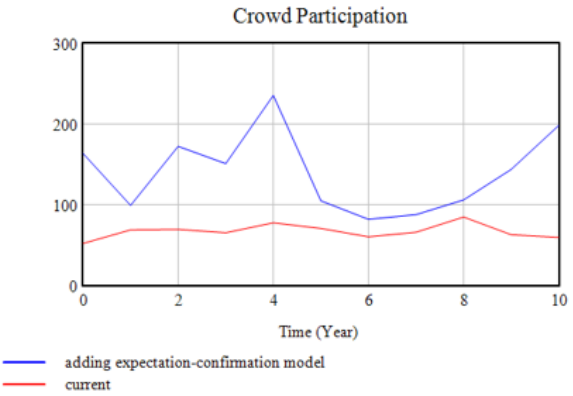


Figure 7. Flow and Stock Diagram After Improving Model

Results suggested that the application of this policy improves the performance of the model and significantly increases the level of crowd participation. As illustrated in Figure 8, by improving the model, crowd participation has increased 113% on average in 10 years.



Time (Year)	0	1	2	3	4	5	6	7	8	9	10
Crowd Participation : current	51.9304	68.774	69.4727	65.2394	77.5469	70.5795	60.1674	65.8946	84.6773	62.8122	59.4368
Crowd Participation : adding expectation-confirmation model	163.565	99.1805	172.335	150.963	235.472	104.838	81.8771	87.7234	105.98	143.783	198.303
Increasing rate of crowd participation	215%	44%	148%	131%	204%	49%	36%	33%	25%	129%	234%

Figure 8. Impact of Improving Model on Crowd Participation

4.2. Crowdsourcer Section

The crowdsource section focuses on crowdsourcer to answer the research question regarding exploring the effective mechanism for reinforcing crowdsourcer to decide to participate in the crowdsourcing of marketing activities. According to the flow and stock diagram, crowdsourcer decision is affected by three groups of variables. The first group regards variables related to the internal environment of the organization or crowdsourcer (including crowdsourcing budget, platform availability, employee knowledge, crowdsourcing expertise, the level of risk acceptance, and the level of technology acceptance). The second group concerns variables related to the crowd (including the need to training or interaction, the number of the crowd, the diversity of the crowd, and crowd knowledge). Finally, the third group involves variables related to the task (including the level of confidential information,

possibility of partitioned task, and the ease of task delineation). Based on its initial value, the development trend of the decision to marketing crowdsourcing is simulated by increasing the values of these three groups of variables by 50%. The results are shown in Figures 9-11.

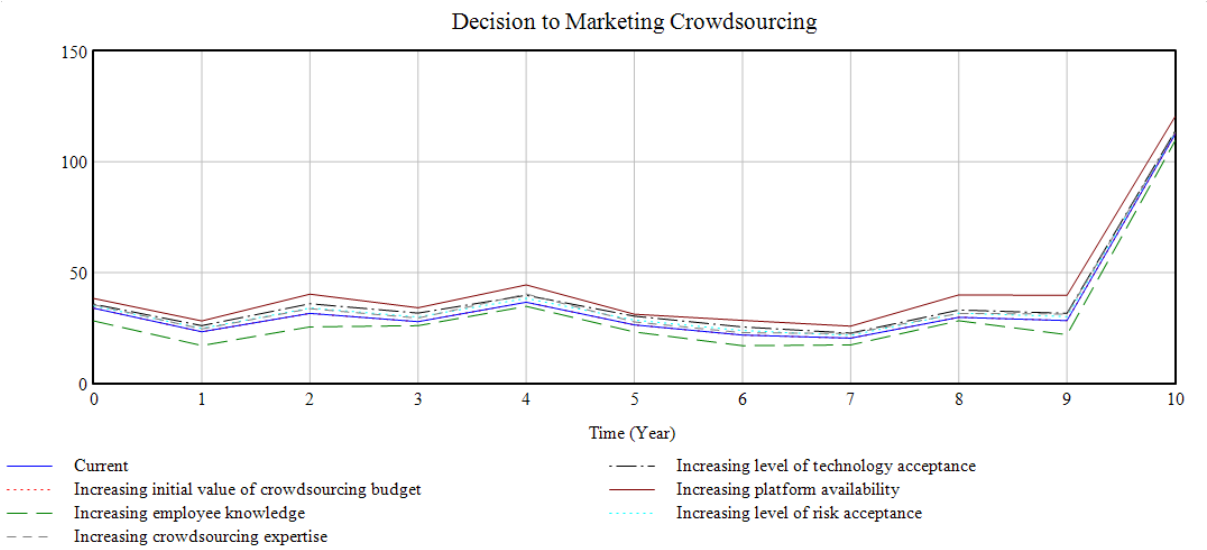


Figure 9. Impact of Increasing Variables Related to the Internal Environment of the Organization or Crowdsourcer on Decision to Marketing Crowdsourcing

As seen in Figure 9, with an increase in variables related to the internal environment of the organization, the decision to marketing crowdsourcing also increased. Nevertheless, the impact of platform availability is more than other variables.

According to Figure 10, with an increase in with an increase in variables related to the crowd per year, the decision to marketing crowdsourcing also increases. However, the impact of crowd knowledge is more than other variables.

Finally, as Figure 11 illustrates, with an increase in the level of confidential information, possibility of partitioned task, and the ease of task delineation, the decision to marketing crowdsourcing (which is positively correlated with these variables) also increases.

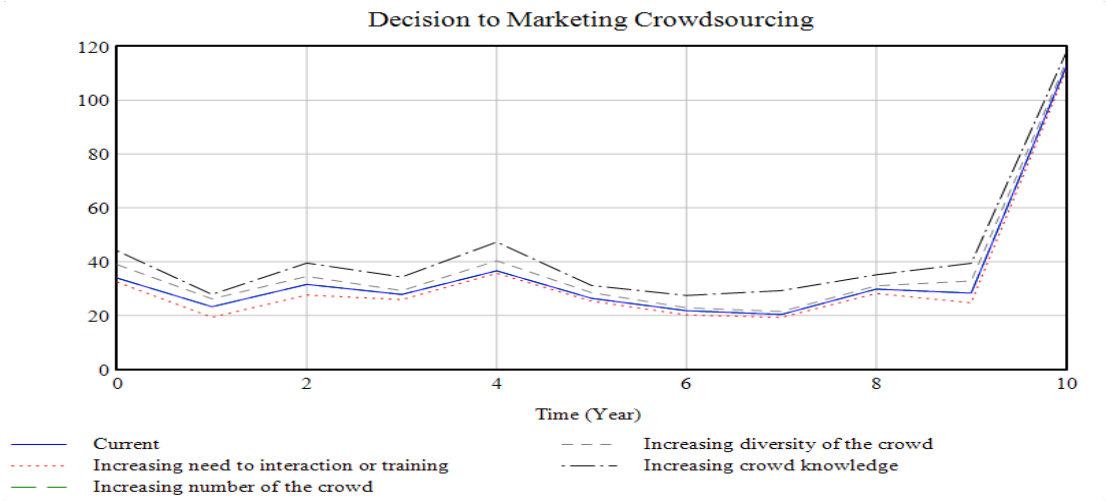


Figure 10. Impact of Increasing Variables Related to the Crowd on Decision to Marketing Crowdsourcing

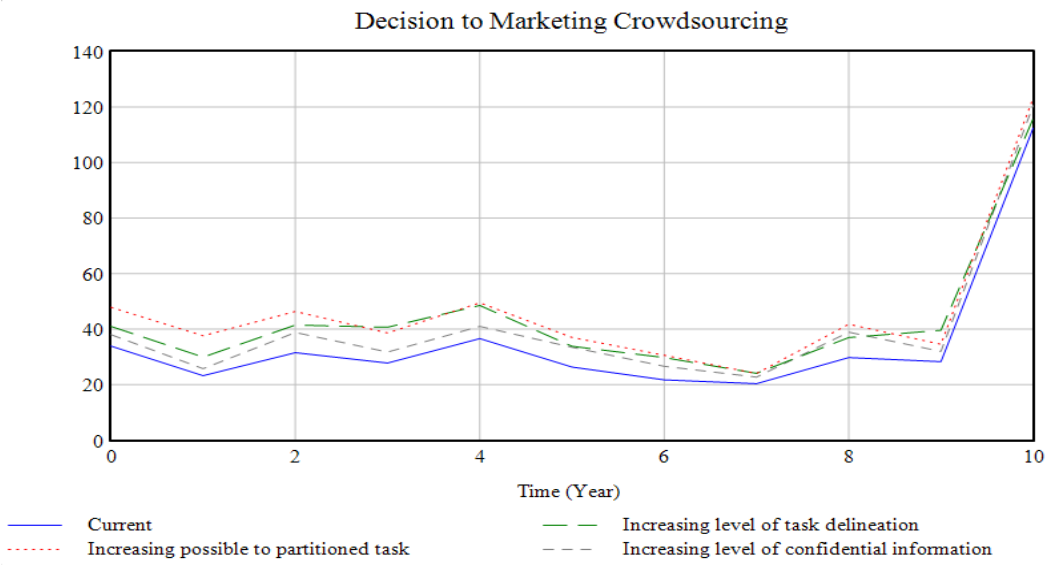


Figure 11. Impact of Increasing Variables related to the Task on Decision to Marketing Crowdsourcing

At the end of this section, the proposed framework we developed – which is introduced in Figure 12 – is based on the important aspects and influential factors that appeared in the literature and system dynamics simulation.

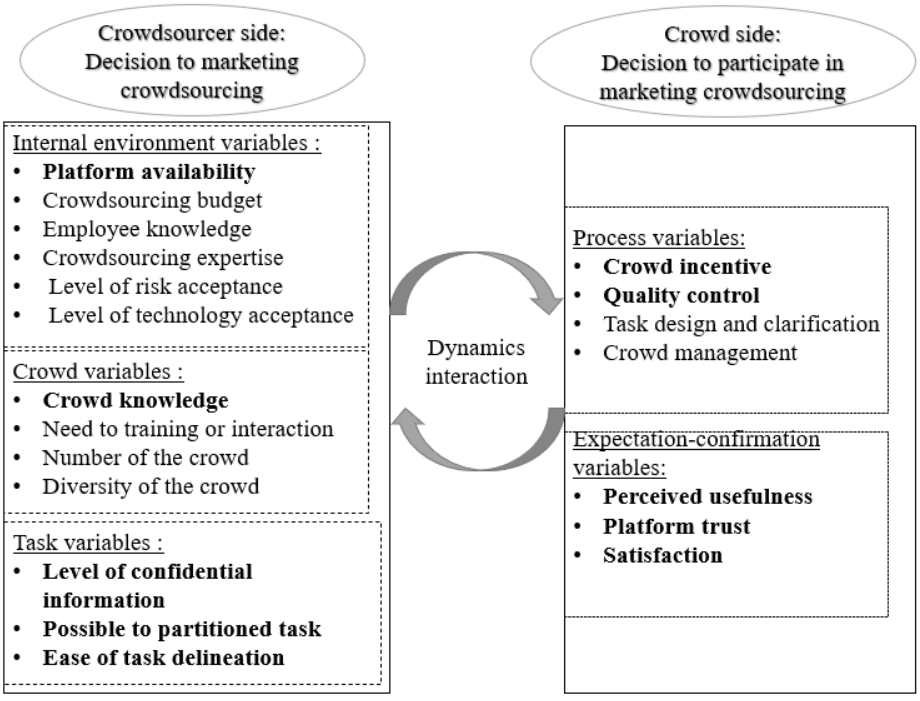


Figure 12. Proposed Framework for the Marketing Crowdsourcing

5. Discussion and Conclusion

Through the concepts and constructs that are highlighted in this study, one can conclude that crowdsourcing is a highly dynamic process that has triggered new opportunities for value creation in marketing, asserting that it can be achieved through the proper combination of the main drivers of both sides, i.e., crowdsourcer and crowd. In this study, by conducting

different scenarios, we found the priorities of the variables in each section (shown with bold-faced characters in Figure 12). In the following, we interpreted the results on the foundation of literature evidence.

5.1. Crowdsourcer Side: Decision to Marketing Crowdsourcing

As revealed in our study, influential factors for the crowdsourcer side can classify into three-parts:

First, the factors that are related to the internal environment include crowdsourcing expertise in the organization, the level of risk acceptance in the organization, the level of technology acceptance in the organization, the level of confidential information, employee knowledge, crowdsourcing budget, and platform availability. The findings here support the preceding literature (Martinez, 2017; Thuan et al., 2017), which asserts that the internal environment is associated with the decision to crowdsourcing. Moreover, according to Schenk et al. (2019), the decision to crowdsourcing is a vital decision directly linking to whether an organization will open or close its boundaries to a crowd. Furthermore, the results reveal the decision to crowdsourcing in this layer is in an important relation to platform availability. The outstanding role of the platform is highlighted in other studies as well (e.g., de Mattos et al., 2018; Kittur et al., 2013).

Second, the factors that are related to the crowd include the number of the crowd, the diversity of the crowd, the crowd need for training and interaction, and crowd knowledge. This research contributes to the current belief among scholars (Gatautis & Vitkauskaite, 2014; Ghezzi et al., 2018) that strategies adopted by crowdsourcer to aggregate the output from the crowd express its intention to use open innovation strategies such as crowdsourcing. Most importantly, it has frequently been expressed that the diverse knowledge held by the crowd is a key success factor in crowdsourcing (Frey et al., 2011; Martinez, 2017).

Third, the factors that are related to the task (e.g., marketing activities) include the level of confidential information, possible partitioned tasks, and the ease of task delineation. The results of this research show that there is a very effective relationship between these task characteristics and the decision to crowdsource. Regarding this, other scholars also express that proportionate matching between crowd and task is an issue for crowdsourcer (Baba et al., 2016; Yin et al., 2020). Thuan et al. (2016) stated that the task with confidential information, including privacy and security issues, requires high interaction with the crowd or can be automated. Additionally, Malone et al. (2010) point out that a crowdsourcing strategy is more adequate for tasks that can be partitioned. Similarly, Afuah and Tucci (2012) illustrate that the ease of task delineation helps the crowd realization, and it may be delineated with different levels of detail matching to different phases of crowdsourcing, which in turn is relevant to the decision to crowdsource.

5.2. Crowd Side: Decision to Participate in Marketing Crowdsourcing

Crowd participation as another important side of crowdsourcing system is affected by four mediator variables: task design and clarification, crowd management, quality control, and crowd incentives. Whereas several researchers (Blohm et al., 2018; Lorenzo-Romero & Constantinides, 2019; Mack & Landau, 2020) suggest that these factors are related to crowd participation, they have not examined their relationship. However, the current research provides a framework that traces the relationship between these factors that influence the favorability of this participation.

The results of this study show the outstanding role of quality control and crowd incentives. In terms of motives, prior scholars have provided discoveries on how contributors to crowdsourcing rate the importance of various motivational dimensions as well. For example, Naderi (2018) explains that incentive mechanisms exert influence over the general motivation and on crowd participation through satisfying the basic psychological needs (i.e., competence, autonomy, and relatedness). Moreover, Frey et al. (2011) demonstrate that financial incentives can improve the perception of fairness, and thereby foster the level of participation. Our findings also suggest that the quality control of crowdsourcing projects is strongly associated with crowd participation. This is confirmed by other scholars as well (Blohm et al., 2018; Bonabeau, 2009).

Finally, to improve the current situation of crowd participation, the authors proposed a policy, and its effects were observed on the system after implementation. The proposed policy includes adding the expectation-confirmation factors to increase the crowd's continued tendency to participate in the crowdsourcing of marketing activities. Therefore, we have added the perceived usefulness, satisfaction, and platform trust to the model. Empirical results showed that all these factors have considerable effects on crowd participation. These findings complement earlier studies (Wang & Wang, 2019; Wu & Gong, 2019) that explain crowd continuance behavior with the consideration of post-expectation. Regarding this issue, Wu and Gong (2021) classified sustained participation into continuous participation intention (CPI) and increased participation intention (IPI), and delegated the need to identify subclasses and details of them for future research. This study extended their work and classified task design and clarification, crowd management, quality control, and crowd incentive as influencing factors for increased participation intention. In addition, perceived usefulness, satisfaction, and platform trust were identified as effective factors for continuous participation intention in the crowdsourcing of marketing activities.

At the end of this section and concerning the results of the present study, the first and main contribution of the current study is proposing a dynamic framework for the crowdsourcing of marketing activities to fill a gap in the research of crowdsourcing and marketing. Several researchers (e.g., Faullant & Dolfus, 2017; Vignieri, 2020) suggested that dynamic interactions between crowd and crowdsourcer are related to crowdsourcing, but they have not examined this relationship. However, the current research provided a validated framework that traced the dynamic interactions between two main sides of crowdsourcing, the factors that influence the decision-making of these sides, and their consequences. Furthermore, it attempted to address the research gaps and respond to previous calls for investigations from the perspective of marketing (Brown, 2019; Farahutdinov et al., 2020).

The identification of influential drivers for successful crowdsourcing with a system dynamics approach is another contribution of this study. Regarding its methodology, this research was one of the first studies to examine crowdsourcing by considering dynamic interactions. According to scholars (Faullant & Dolfus, 2017; Rui & Guijie, 2018), the application of dynamic thinking in crowdsourcing phenomena might be suitable for theory building.

Lastly, this article investigated the priorities of drivers that might lead crowdsourcing to be developed and to effectively engage crowd and crowdsourcer. To achieve this, by conducting different scenarios, this study proposed five categories of drivers to support both side's decision-making.

6. Implications

With crowdsourcing of marketing activities, companies can take advantage of the crowd potential and reduce their costs. However, managers need to be aware that crowdsourcing is

not a static process, but a complex and dynamic system that provides a wide range of innovation capabilities. For this section, the main intention of the current research was to empirically test multiple scenarios regarding the influential factors and consequences of successful crowdsourcing. By exploring drivers of success of this multi-sided phenomenon, this research first enables decision-makers and marketing managers to identify how to organize favorable crowdsourcing.

Communications will be very different during COVID-19 and a post-pandemic period. This is because people are now encouraged to avoid physical contact and distance themselves socially. Thus, the value of new digital techniques such as crowdsourcing for innovation and value creation is vital and considerable for marketing managers. This research provides the opportunity for organizations and their managers to use the potential of this technology to advance their marketing goals.

Our review has shown that platform availability, crowd knowledge, and all three indexes of task variables are outstanding drivers for organizations to decide on crowdsourcing. Essentially, we recommend to crowdsourcer an optimized allocation of limited resources. The optimization aims to match the features of tasks with the crowds' abilities and knowledge. On the other hand, crowdsourcer as the platform owner must consider the availability and perceived usefulness of the platform, which increases the number of users who join the platform and extends crowd networks.

As a pioneering study in the crowdsourcing area that carries out a system dynamics approach, this study findings indicate that to achieve a competitive advantage, corporations should clearly understand favorable crowd participation, which is influenced by two main group factors, namely process variables and expectation-confirmation variables. The empirical results of this study recognize the relative weighting of the crowd incentives, quality control, and expectation-confirmation variables that affect crowd participation. Accordingly, this research has significant implications for managers when creating or modifying favorable crowd participation.

7. Limitations and Future Research Directions

This study has some limitations that we must acknowledge for the direction of future research. First, for the quantitative part, we collected the data from only a single organization. Although it is a leading and popular company with worldwide facilities that have crowdsourcing experience in recent years in the marketing field that was an important item for this study, to ensuring the generalizability of the research findings, it is recommended that a future study be undertaken to repeat this research in other countries and different companies (to ensure external validity).

In addition, more work will need to be done to provide more definitive evidence on the effects of the identified factors on decision-making. Future studies can design a fuzzy expert system to choose crowdsourcing processes using effective factors. Future research can also examine different clusters of crowdsourcing by system dynamics methods such as crowd voting or crowdfunding.

Lastly, future scholars could perform comparative studies based on our framework for different types of marketing activities and identify more in-depth outcomes in this field of study.

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Appendix A
Model Parameters

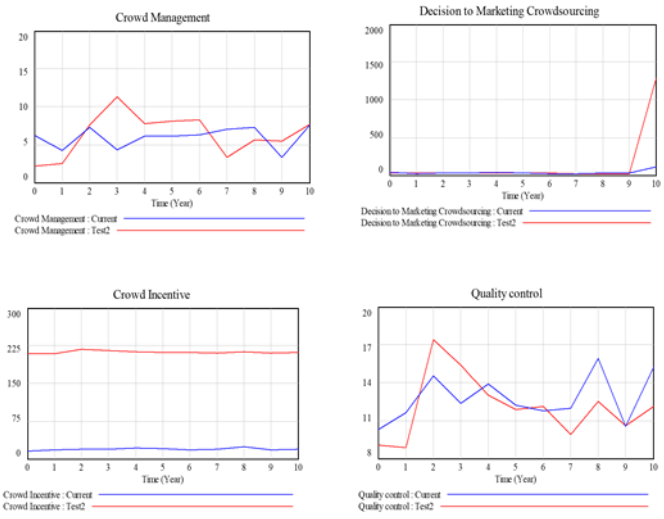
No	Variable	Type	Equation
1	Decision to marketing crowdsourcing	Auxiliary	crowd knowledge + lookup 3 (crowdsourcing budget) + crowdsourcing expertise + diversity of the crowd + ease of task delineation - employee knowledge + level of confidential information + level of risk acceptance + level of technology acceptance - need to interaction or training + lookup 4 (number of the crowd) + output quality + platform availability + possibility of partitioned task
2	Task design and clarification		lookup 2 (decision to marketing crowdsourcing) + description of qualification requirement - level of task complexity
3	Crowd management		crowd performance + task assignment rate + task design and clarification
4	Quality control		crowd management + expert evaluation + identification of crowd malicious behavior
5	Crowd incentive		extrinsic incentive + intrinsic incentive + quality control
6	Crowd participation		3 * crowd incentive
7	Output quality		delay fixed (2 * crowd participation, 10, 1)
8	Creativity in marketing		4 * output quality
9	Marketing cost	Rate	lookup1(creativity in marketing)
10	Crowdsourcing budget	State	INTEG (marketing cost,10000)

Appendix B
Measurement Items of the Questionnaires

constructs	Sub-constructs (References)	Cronbach's alpha
Questionnaire1: Related to crowdsourcer side of dynamic model		**0.88**
Decision to marketing crowdsourcing	-Possibility of partitioned task (Blohm et al., 2018)	0.91
	-Ease of task delineation (Piazza et al., 2019)	0.79
	-Number of the crowd (Prpić et al., 2015)	0.85
	-Diversity of the crowd (Bonabeau, 2009)	0.78
	-Crowd knowledge (Martinez, 2017)	0.90
	-Crowdsourcing expertise in organization (Thuan et al., 2018)	0.84
	-Level of risk acceptance in organization (Thuan et al., 2018)	0.82
	-Level of technology acceptance in organization (Ghezzi et al., 2018)	0.92
	-Platform availability (de Mattos et al., 2018)	0.85
	-Level of confidential information (Thuan et al., 2018)	0.78
	-Need to training or interaction (Prpić et al., 2015)	0.90
	-Employee knowledge (Thuan et al., 2018)	0.94
	-Crowdsourcing budget (Schenk et al, 2019)	0.93
Questionnaire 2: Related to crowd side of dynamic model		**0.86**
Task design and clarification	-Description of qualification requirement (Ghezzi et al., 2018)	0.92
	-Level of task complexity (Zheng et al., 2011)	0.86
Crowd management	-Crowd performance (Hoornaert et al., 2017)	0.81
	-Task assignment rate (Blohm et al., 2018)	0.94
Quality control	-Identification of crowd malicious behavior (Faullant & Dolfus, 2017)	0.88
	-Expert evaluation (Ghezzi et al., 2018)	0.78
Crowd incentive	-Intrinsic incentive (Wu & Gong, 2021)	0.95
	-Extrinsic incentive (Wang & Wang, 2019)	0.81

Appendix C
Test Results

Test 1. Boundary Adequacy Test Results



Test 2. Extreme Conditions Test Results