

Using Social Media in Open Innovation: Opportunities and Challenges

S. Hamed Ghanadpour

Faculty of Management and Accounting, Shahid Beheshti University, Tehran, Iran

Email: ghanadpour@gmail.com

Sajad Shokouhyar

Shahid Beheshti University, Tehran, Iran

Email: s_shokouhyar@sbu.ac.ir

Abstract—Open innovation is relatively a new category in organizations. Organizations are encouraged to share their R&D infrastructure in open innovation approach and attach other's R&D and innovation to their own value chain through creating technical platforms or joint ventures. Social media is one of the tools of communication in the current business world. Social media creates a platform for cooperating and encouraging people for social activities. Considering the expanded role of social media in encouraging participation and gaining external knowledge in an organization, research is missing in this relationship. Papers dealing with social media and open innovation are really limited. So, in the current research, we study the results of using social media in open innovation. As there are limited researches, it is difficult to base a research project on available studies. So we study this area by deductive approach, Delphi method. In order to do so, we collected ideas of 12 experts from fintech industry and prioritized and analyzed them with the Delphi method and finally reached to 16 opportunities and 21 challenges. From experts' point of view, the most important opportunities are increasing the number and quality of received ideas. The most important challenges are creating new methods for receiving ideas to decrease unrelated content and information validation, and legislation. Finally we categorized the opportunities and challenges and presented them as a framework and model.

Index Terms—open innovation, social media, opportunity, challenge, Delphi

I. INTRODUCTION

Nowadays, innovation is of increasing importance due to decreased products life cycle and the technology used in them [1]. In the past, traditional procedure of R&D and problem solving, suggested many new ideas to an organization every year. Today, there exists thousands of new ideas in the organization effortlessly. This has buried organizations under new ideas and data. In order to use the resources systematically and connect developing and decision making processes to external resources properly, it is necessary to have a coherent approach to face this situation. In the time that organizational borders are weaker than ever and Open Space is a common approach

in organizations, the complexity of information and knowledge out of the organization, can lead to more complexity in the organization. "Open Innovation" is a reaction to this situation.

Organizations are encouraged to share their R&D infrastructure in Open Innovation approach and attach other's R&D and innovation to their own value chain through creating technical platforms or joint ventures.

Social media is one of the tools of communication in the current business world [2]. Social Media has affected different aspects of human relationships [3]. Virtual Space and emergence of social applications and software, have led companies encounter new communication facts. Social Media is an important source of information nowadays. This Media has changed companies' tools and strategies for communication. In fact, information control is in the client's hand [4].

Social media creates a platform for cooperating and encouraging people for social activities. There is clear evidence showing that people are more inclined for public participation than using online social media [5]. As a result, we can say that this media is of high potential for online public participation in a society [6].

Considering the expanded role of social media in encouraging participation and gaining external knowledge in an organization, research is missing in this relationship. Due to this issue, research question will be:

Research question: *What are implications (challenges and opportunities) of using social media in Open Innovation approach?*

An exploratory Delphi study with industry experts is applied to answer the research question.

The paper format will be as follows: literature review will be in the first section. In the second section the research methodology as applied in the Delphi study will be elaborated. The third section will be dedicated to the findings and overall results from the three rounds of the Delphi study. Finally discussion, conclusion and suggestions for future research will be presented.

II. LITERATURE REVIEW

Using Open Innovation, firms complete their normal innovative activities by controlled knowledge entrance [7]. The basic assumption in open innovation approach is

that useful knowledge is distributed everywhere (inside and outside the organization) [8]. This assumption means that every R&D organization, regardless of its size and capabilities, should make effort to have access to useful sources of information outside the organization and create value according to business model goals [9]. Peter Senge emphasizes that firms, in order to be stable, need partnership with external stakeholders that “will give you access to expertise that you can’t grow fast internally” [10].

One of the main factors of open innovation is how to search for ideas and knowledge outside the organization. This process of outside-in, is called inbound open innovation [11]. Studies show that companies using inbound open innovation have access to knowledge with more quality, quantity and variety [12].

Social media consists of a set of online tools that give access to new and simple ways for communication with people. Social media is used for various goals; networking, communicating and sharing [13].

Studies show that internet search and using communicative tools have a positive effect on R&D efficiency in the organization [14]. Social media gives access to more and variety of people and outside knowledge. This is because social media has more flexibility and freedom for cooperation. On the other hand they do not have negative effects of traditional media such as losing autonomy, social pressure for confirmation, and being stuck in groupthink [15]. Social media enables users to comment with their own preferences and judgments. Kijkuit, van den Ende (2010) show that larger networks lead to more ideas which are useful for innovation. Due to easy access and clarity of social media, amount and variety of knowledge available for exploration will increase [16].

Applying technologies in social media gives access to a comprehensive and powerful tool for inbound open innovation activities which enables the firm to achieve outside knowledge and make use of it [17], [18]. Social Media driven Open Innovation (SMOI) in the form of online channels such as innovative hubs are growing rapidly; because they have the potential to attract variety of knowledge and innovation from a vast network of users and colleagues [17].

Firms using SMOI, will have access to more technological solutions from external stakeholders of the organization [19]. The higher the technology, the more access the company has to valuable technical information from stakeholders (customers and other groups) and it can transform the knowledge of the customer to more advanced products [20].

There has been extensive studies on social media and open innovation and there are papers with high frequency for each. However, papers dealing with social media and open innovation are really limited. We tried to look at papers in this section that have “open innovation” and “social media” in their key words. There is a summary of such papers in the following section based on publishing year.

A. Review Articles

Degen (2009) [21] has elaborated on crowdsourcing ideation and different stages of using social media for innovation in his working paper, and has provided some examples from various websites which gather ideas.

Kärkkäinen, Jussila and Väisänen (2010) [22] have studied using social media in b2b innovation of 122 companies in Finland, and extracted its challenges by a questionnaire.

Pillar, Vossen and Ihl (2011) [23] worked on effect of social media on customer co-creation in their paper. Customer co-creation is an active cooperation between the producer and consumer in developing a new product. This paper is about how social media affects customers involved in the process and the hosting firm. Pillar *et al.*, show that social media is a double-edged sword. Social media can make economic relationships collaborative and social. On the other hand however, it can make social relationships marketing communications because it creates an intense competition among players.

Mergel (2012) [24] has studied innovation challenges of social media in public sector and suggested solutions.

Mount and Martinez (2014) [17] had done three case studies and considered use of social media in the whole process of innovation (ideation, R&D, commercialization).

In ideation process of the case study, the speed and quality of ideas were significantly high, and regulation and social media control were recognized as the main challenges.

In the case study regarding R&D, they could find out about consumers’ preferences and develop production line of the new product by ideas, votes, and conversations in Facebook page of the company. In this case, the main challenge was lack of internal capability for analyzing the content uploaded in the Facebook. It was recognized that hierarchical structure and internal culture of the company were limiting factors in using social media for R&D.

In the case study on commercialization, the company could carry out the biggest marketing project of its history in terms of scale and scope with the help of social media (Facebook). Lack of ability in managing the platform and collecting desirable data were the challenges, and risk averse culture in the organization and managers inertia created barriers.

Ooms, Bell and Kok (2014) [16] had studied the effect of applying social media in inbound open innovation, on absorptive capacity of the company. They studied seven exploratory cases in R&D and business of two big companies with globally advanced technologies. Applying social media in innovation processes have been studied in these companies. In one of the cases, there has been a real attempt to utilize presented ideas in the specific group in the social media. Results show that if conditions are met, using social media leads to increase in transparent, moderate, and multidirectional interactions which in turn affect four abilities for absorptive capacity: communications, socialization tactics, cross-functionality and adoption, the ability which has been ignored up to now. Therefore, social

media are boundary-spanning tools that can be used for building and increasing absorptive capacity of the firm.

Du, Bstieler G, Yalcinkaya (2016) [20] have studied the roles of sustainability and Social Media driven Open Innovation (SMOI) on new product development function. In addition, they followed an improved approach by separating different activities of SMOI. In order to do so, this study has developed a conceptual framework that predicts (1) Sustainable Orientation (SO) of the company has a positive correlation with product development function; (2) Customer Focus (CF) intermediates a part of SO-NPD function link and (3) special activities of SMOI, adjust CF-NPD function link.

Loukis, Charabidis and Androutsopoulou (2017) [25] have tried to use open innovation in public section and benefited from citizen knowledge for development of innovation in policymaking and public services. This paper has presented a method for related Social Media Monitoring (SMM). In this method has introduced processing the content and extracting external knowledge related to favorite areas of the government to advance open innovation. A multidimensional framework is presented for evaluation. This framework includes political, crowdsourcing, and diffusion dimensions.

Hitchen *et al.* (2017) [26], have studied the process of using enhanced open innovation with social media in SMEs. They found out opportunities and challenges of SMEs for using open innovation with social media by doing a case study about a startup. Challenges include too many interactions, as it is time consuming to check ideas, making ideas into profit, and trust.

B. Research Gap

According to the literature, except for Ooms *et al.* (2014), recent studies have not worked on advantages and disadvantages of using social media in open innovation and this kind of study is missing here. Although there are so many papers on open innovation, the intersection of open innovation and social media is just limited to aforementioned studies. Regarding this summary outline, it is difficult to base a research project on available studies.

It seems reasonable to study this area by deductive approach, because it leads to identifying main issues. This deductive approach does not require many previous studies. Regarding all these points, methodology of the research is introduced in the following section.

III. METHODOLOGY

A. Methodology Application to Find the Research Question

Delphi method [27] was recognized appropriate for this study. This method allows us to have access to experts' ideas and beliefs structurally [28]. Delphi is a survey based on experts ideas which is carried out in two or more rounds. In each round, results of previous round are presented to respondents as the feedback. Therefore experts' response in the second round is affected by other experts' ideas in the first one. Hence, Delphi method is a group relationship process which is structured quite

strong. In this method, experts judge topics about which there is incomplete and uncertain knowledge. The main purpose is to predict future events. Considering novelty of using social media in companies, which is true about open innovation as well, it is reasonable to choose this approach. In order to answer the research question, deep knowledge is needed.

Consulting informed experts is a feasible way to achieve required insight. One of the Delphi method's strengths is that we can reach valid group consensus. Delphi's repetitious approach gathers high quality responses from experts [29]. One of the most important advantages of the Delphi method, is the flexibility, in which participants themselves determine the way and place of response. This avoids opinion-leaders dominating discussion. Experts express their opinion about the same question at least two times, and it is possible for them to change their mind after obtaining information from others. In fact negative effect of participants' personality and status influence on others' responses is avoided [27].

Due to the fact that effectiveness of the Delphi method depends on its implementation [30], utmost care was taken in data collection. From methodology point of view, transparency in research process together with the archive of all experts' responses, guarantee reliability and value of results.

B. Research Design

We start data collection with open questions according to Rowe *et al.* (1991) [31]. This leads to achieve vast information from experts group. The items emerging this way will be a platform for the quantitative polls.

As academic research is limited at the intersection of open innovation and social media, the authors decided to make use of an exploratory practitioner-involved research approach. Experts were chosen from a leading company in financial technology industry.

Considering two assumptions, it seems suitable to choose experts from this industry. The first assumption refers to the novelty of the research topic which links the areas of social media and open innovation. There are a few industries working in both of these areas and have access to experts. The second assumption depends on the fact that authors were allowed to communicate with the company's experts and had strong relationship with the company. Since it is difficult to achieve experts' commitment in the Delphi study [32], having direct access to the company is one of the important factors.

All in all, 15 experts were convinced to participate in Delphi study. Considering Okoli and Pawlowski (2004) [28] suggestion, sample size seems to be appropriate. The research process applied three polls of expert feedback. As recommended, three rounds will be sufficient in a Delphi study to provide stable feedback [28]. Following cut-off criteria of Delphi study, this approach was selected; because by an extra Delphi poll, no further insights and no improvement in answer quality can be derived [33]. In this situation, two consecutive rounds of Delphi yield stable feedback with very little variations in results. Limiting rounds of Delphi to three polls,

increases participants' willingness to participate. Increasing the number of rounds can have a negative effect on the response rate.

C. Data Collection Process and Response Rate

Data collection process of Delphi was carried out in August and July of 2019. Through three polls, experts were asked to write down their feedbacks and submit them in one week after receiving the questionnaire. Before sending the questionnaire in each round, we checked its consistency and comprehensiveness through a primary test with an expert. Using a primary test to guarantee reliability has been used previously by researchers (such as [33]). If an expert does not respond, they will be eliminated from subsequent polls.

Participation rate was 80 percent (12 people) in the first round. These people continued their cooperation in round 2 and 3 (100 percent participation).

D. Data Analysis

The first round was designed in a way that it gave high levels of freedom for participants to answer so that their ideas were not limited. On the other hand it was possible to compare responses to an acceptable extent. Experts were asked to mention 3 to 5 opportunities and challenges regarding the main question in the first round. The question was divided into two sub-questions.

Main question: What are the potential functions of using social media in open innovation in the organization?

Sub-questions: What are the potential challenges of using social media in open innovation in the organization? What are the potential opportunities of using social media in open innovation in the organization?

In the first round, experts presented 103 responses in answer to these 2 sub-questions. These cases gathered in 37 groups (16 opportunities and 21 challenges in Table I) using qualitative cluster analysis approach [34] in order to extract similarities among responses and underlying topics.

TABLE I. CHALLENGES AND OPPORTUNITIES OF USING SOCIAL MEDIA IN OPEN INNOVATION

Opportunities	Challenges
1. Increasing the number of received ideas	1. Creating new methods for receiving ideas to decrease unrelated content and information validation
2. Increasing quality of received ideas	2. Legislation
3. Decreasing costs of R&D	3. Human perceptual errors due to collaboration in virtual space
4. Enhancing product development	4. Lack of focal control on target group comments and joining
5. Using collective wisdom	5. Need to use resources for ideas analysis
6. Speed of market reach and time to market	6. Lack of participation from senior managers and intra-organizational stakeholders
7. Improving User Experience (UX)	7. Information and virtual space security
8. Developing brand innovation	8. Confidentiality of information
9. Possibility of improving ideas gradually	9. Infrastructures and IT capabilities
10. Understanding customer's behavior	10. HR issues and leaving work forces
11. New business models	11. Business strategies
12. Market strategy	
13. Risk management	
14. Access to information and data	

15. Increasing popularity of brand	12. Anonymous identity in virtual space
16. Market development and market penetration	13. Existence of fake news
	14. Competitors
	15. Load of information
	16. Psychology of audience
	17. Effect of environmental components (temporary factors)
	18. Organizational culture
	19. Lack of agility in organization
	20. Capability in analyzing information and received ideas
	21. Risk aversion in organization

In the second round of Delphi which has quantitative nature, extracted factors in the previous round were presented to experts for categorizing and prioritizing. Okoli and Pawlowski (2004 p15) consider the process of prioritizing factors by experts as an approach that helps the researcher select more effective factors. In order to evaluate the factors, we used 5-point Likert scale for rounds 2 and 3, ranging from "very high" (rating 5), "high" (rating 4), "medium" (rating 3), "low" (rating 2) to "very low" (rating 1), to evaluate individual factors. In addition, the "not applicable" (rating 0) option was included. Finally we calculated the mean value (\bar{x}) for each group of factors. We used the mean value to compare the factors. In order to identify the highest ranking items in each sub-section, it was required to sort the factors in descending order based on their mean group value.

In the third round, if there were a contradiction between prioritizing of each expert and the mean value, we gave it back to them. Due to numerical feedback, experts could review their points, compare them with the mean value of the group and change their answers if necessary. Compared to the second round, few changes were observed. Therefore we came to this conclusion that developing more Delphi rounds will not lead to noticeable changes.

Regarding stability of the study, it is worth mentioning that Delphi method includes different rounds which are repeated until reaching stable results, therefore results of the study can be counted as stable. However, the authors tried to document all research steps in order to achieve the results as transparent as possible.

IV. OUTLINING THE FINDINGS OF DELPHI ROUNDS

Round 1

As mentioned earlier, each expert was asked to write down 3 to 5 challenges and opportunities in response to two open questions. All responses were collected and categorized based on similarities and repetition. As a result, 16 opportunities and 21 challenges were collected.

Round 2

Round 2 was dedicated to quantitative evaluation. Factors from the previous round were prioritized in this round. 5-point Likert scale was used to prioritize. Prioritizing by 12 experts was integrated and evaluated from statistical point of view.

“Increasing the number of received ideas” had the highest rank among opportunities ($\bar{x} = 4.67$). The second factor was “Increasing quality of ideas” ($\bar{x} = 4.4$). Out of 16 opportunities, 5 had a mean more than 4.

The highest mean of challenges was for “Creating new methods for receiving ideas to decrease unrelated content and information validation” and “Legislation” ($\bar{x} = 4.4$). “Human perceptual errors due to collaboration in virtual space” had the next rank ($\bar{x} = 4.25$). 4 of 21 challenges, had a mean higher than 4.

Round 3

Round 3 is the second quantitative evaluation in Delphi. In this round, experts are allowed to validate their responses in round 2 based on group responses. The aim of this round is to improve responses and reach an evaluation which is more balanced.

In this round, out of 12 experts only 4 made some minor changes in their own responses and others confirmed their first responses again. Therefore we achieved our goal in the round 3 which had more stable and balanced group responses.

In this round, the number of opportunities with a mean value higher than 4 was 7 opportunities (Table II) and challenges with a mean value higher than 4, were 5 challenges. (Table III)

Opportunities were as follow:

- Increasing the number of received ideas
- Increasing quality of received ideas
- Decreasing costs of R&D
- Enhancing product development
- Using collective wisdom
- Speed of market reach and time to market
- Improving User Experience (UX)

Challenges include:

- Creating new methods for receiving ideas to decrease unrelated content and information validation
- Legislation
- Human perceptual errors due to collaboration in virtual space
- Lack of focal control on target group comments and joining
- Need to use resources for ideas analysis

We will discuss these factors more in the following section.

TABLE II. RATING OPPORTUNITIES OF USING SOCIAL MEDIA IN OPEN INNOVATION (SOURCE: AUTHORS)

Opportunity	Mean value	Number of experts with rating					
		5	4	3	2	1	0
Increasing the number of received ideas	4.67	8	4	0	0	0	0
Increasing quality of received ideas	4.42	7	3	2	0	0	0
Decreasing costs of R&D	4.33	7	3	1	1	0	0
Enhancing product development	4.25	6	4	1	1	0	0
Using collective wisdom	4.16	6	3	2	1	0	0
Speed of market reach and time to market	4.08	5	4	2	1	0	0

Improving User Experience	4.00	5	4	1	2	0	0
Developing brand innovation	3.83	4	4	3	0	1	0
Possibility of improving ideas gradually	3.50	3	4	2	2	1	0

TABLE III. RATING CHALLENGES OF USING SOCIAL MEDIA IN OPEN INNOVATION (SOURCE: AUTHORS)

Challenge	Mean value	Number of experts with rating					
		5	4	3	2	1	0
Creating new methods for receiving ideas	4.42	7	4	0	1	0	0
Legislation	4.42	6	5	1	0	0	0
Human perceptual errors due to collaboration in virtual space	4.25	6	4	1	1	0	0
Lack of focal control on target group comments and joining	4.08	5	4	2	1	0	0
Need to use resources for ideas analysis	4.08	5	4	2	1	0	0
Lack of participation from senior managers and intra-organizational stakeholders	3.83	4	4	3	0	1	0
Information and virtual space security	3.58	3	4	2	3	0	0

V. AGGREGATING THE FINDINGS

The purpose of this section is to conclude challenges and opportunities of using social media in inbound open innovation, applying Delphi method to answer research question. In order to achieve a balanced approach, we take factors into account with mean value higher than 4.0. We consider the opportunity of “Developing brand innovation” and the challenge of “Lack of participation from senior managers and intra-organizational stakeholders” as well, because at least 4 experts ranked them as “very high”. It does not mean that other factors are unrelated but it shows that these factors were less related from experts’ point of view.

A. Opportunities of Using Social Media in Open Innovation

Increasing the number of received ideas and solutions: It is important for every organization to receive ideas and that is why there are so many techniques for receiving ideas in organizations; different types of brainstorming, knowledge management systems, receiving ideas mechanisms and etc.

Therefore, it is concluded that organizations are looking for more inputs for receiving ideas and spending money on. The cost index for receiving each idea in organizations might be monitored as well.

One of solutions for increasing ideas is creating network of people and experts for receiving ideas. Social networks are rich sources of ideas and solutions which can be recognized as the most important opportunity of social media in open innovation.

Increasing quality of received ideas: Foregoing mechanisms of receiving ideas look for increasing quality of receiving ideas as well. Importance of increasing quality is no less than importance of quantity since increasing quantity of ideas and solutions will cause the

challenge of using resources to review those ideas and solutions. Due to the fact that social media reflects real and explicit opinions of the audience (including customers and consumers), it can lead to an increase in quality of ideas. Direct and sincere interaction with the audience and expressing things that are normally not said in formal situations and polls, are advantages of social media. These advantages in open innovation create an opportunity to increase quality of received ideas.

Decreasing costs of R&D: From the past, organizations have constantly emphasized on R&D and tried to spend money in this regard. With development of knowledge borders and arrival of technology, research and development are of higher importance. Considering pervasiveness of research, its costs have risen in a way that costs of R&D have turned into a challenge for each organization in all fields. Some organizations are looking for ways to reduce such costs and have limited their research scopes.

Open innovation is a solution for reducing costs of R&D. A better solution for reducing costs is when social media enters the organization as an input for open innovation.

Enhancing product development: Nowadays due to intense competition, product development is a major goal for customer-oriented organizations. Product development consists of different steps such as understanding the needs, ideation and validation of ideas. In today's world, product development is looking for open innovation not only to enhance developed new products but to reduce costs of different stages.

Due to its extensiveness and boundlessness, social media can spread ideas of product development with amazing speed and enhance different stages of product development.

Using collective wisdom: Experts' opinions are of high importance in so many methodologies. Physical limitations have always been a challenge in methodologies and collective wisdom can be used less often in them.

Social media is a suitable tool for utilizing collective wisdom which is counted as an opportunity in open innovation.

Speed of market reach and time to market: Time is highly important in ideation and product and business development. A successful firm is the one which reduces the time of market reach from idea to a product that is kind of meeting customer's need. Social media in open innovation accelerates this process and creates an outstanding opportunity by faster and more up-to-date recognition of the customer's need and main products. It is possible to predict the needs by analyzing media's content and accelerate it even more.

Improving User Experience: Nowadays user experience and more developed concept of Customer Journey is highly important in presenting the product and service. Considering a close interaction with customers, utilizing social media in open innovation can create a considerable opportunity for improving user experience. This is of outstanding importance in developing both the product and service for organizations.

Developing brand innovation: Today's brands consider numerous areas for their development and one of these areas is innovation. Open innovation can be a great help in developing brand innovation and using social media is a suitable stimulator. In addition to enhancement, it can create an image of innovative brand by informing, proper advertisement and even the way of using opinions and ideas. Sense of participation and innovation help make the organization brand among audiences.

B. Challenges of Using Social Media in Open Innovation

Creating new methods for receiving ideas to decrease unrelated content and information validation: Content validity is one of the major challenges of using content in social networks and media. A massive amount of information is produced in social networks by people. A large amount of the produced content is personal impressions, unrelated content, jokes and even intentional mistakes. Due to these reasons, verification and validation of information are important and counted as challenges in this regard. Therefore it is a challenge to create correct methods for receiving ideas in a way that unrelated content is reduced, in order to decrease costs of verification and validation. This challenge is solved through systematic algorithms and human supervision.

Legislation and control: Legislation challenges are important in any new phenomenon. Legislation challenges are of special importance in virtual and cyber space which have not come to any proper conclusion due to uncontrollability of virtual space. Social media and networks are not exceptions to this rule and complexities of legislation might be more here due to different reasons such as international interactions.

This issue is highly important in using social media in open innovation. For instance, intellectual property of received ideas can be a serious challenge and create a challenge for any organization in open innovation.

Human perceptual errors due to collaboration in virtual space: Humans are always at risk of perceptual errors in interaction spaces. The possibility of these errors are more in virtual space because of development of interactions and we are always at risk of such errors in one-to-many interactions. For instance for comments under a post in social networks, it is always probable that first comments affect others' opinions and cause perceptual errors; in a way that they think what they have perceived from others' comments is their own idea. This is different from the first challenge (which might be intentional or because of lack of knowledge about unrelated content). Identifying such perceptual errors is more complicated. There are some other challenges as well. For instance a social or environmental phenomenon (such as a public or national event or natural disasters, flood and earthquakes) can affect public attitude for a while and have effect on any idea.

Lack of focal control on target group comments and joining: Determining target group is always a major factor in any field. Due to lack of focal control for joining virtual space, it is not possible to identify audiences'

characteristics and the only way to do so is by asking them. Demographic and geographic features and other factors for segmentation in virtual space are easily recognizable and separable. It is difficult to identify target groups and receive their ideas for open innovation.

Need to use resources for idea analysis: Due to foregoing challenges, analysis of received ideas is one of the most important issues in the study process. Great amount of information is one of the features of virtual space and social media and networks. Hence we need to use resources to consider and analyze information and received ideas. It is achieved by creating smart systems, but this is not enough. It is necessary to make use of group of experts in the process of receiving ideas and this resource should be prepared and optimized.

Lack of participation from senior managers and intra-organizational stakeholders: Generally new phenomena would face with some oppositions in organizations. This will be enhanced if external factors are involved and hence reduces participation of stakeholders. We encounter the challenge of lack of participation of senior managers and intra-organizational stakeholder in open innovation. On the other hand, trust rate to social media in previous generation (x generation) has a dramatic decrease. Therefore using social media in open innovation, more than many factors, has faced with possibility of organizational opposition or at least lack of participation from senior managers and intra-organizational stakeholders.

VI. DISCUSSION AND CONCLUSION

In this study, we considered the intersection of open innovation and social media. We used Delphi method with a panel consisted of 12 experts in open innovation. Delphi results help expand current knowledge by presenting 37 challenges and opportunities in using social media for open innovation. Findings were not strange or amazing however, their results categorized our understandings. This study presents a collection of ideas to research community which can be used as a base for other researches on using social media for open innovation.

In order to simplify reviewing challenges and opportunities, we categorized them into 4 groups; individual, organizational, technical and environmental factors (Fig. 1 & Fig. 2). Individual factors are the ones which depend on human behaviors; like perceptual errors. As the name suggests, organizational factors are those related to inside the organization and its structure; such as using resources for analyzing ideas. Technical factors are somehow subsets of organizational factors, but because of their importance we have separated them. Environmental factors which are related to external environment in which the organization works. Following models are due to this categorization.

As shown in Fig. 1 and Fig. 2, most of challenges of using social media in open innovation are related to organizational and technical factors. Therefore, firstly it is necessary to create appropriate conditions in our organization in order to be successful in using social

media. This is important for managers who are willing to use new methods for innovation.



Figure 1. Opportunities of using social media in open innovation (source: authors).



Figure 2. Challenges of using social media in open innovation (source: authors).

Using social media for open innovation and its challenges and opportunities is being discussed by research and scientific community like all other newfound concepts. Delphi findings help develop current

knowledge by extracting 37 opportunities and challenges regarding social media and open innovation and create a base for future researches.

Findings of this study and the presented model is a great help in making a deeper understanding of opportunities and challenges which using social media in open innovation gives to industries. According to this study, other researchers can work on problems of using social media for open innovation in the organization. They can study solutions of challenges and problems as well. This is useful from scientific and management point of view; since it gives a comprehensive view about this new innovation tool.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

Sajad Shokouhyar conducted the research and facilitated the design of the research. Hamed ghanadpour collected and analyzed the data and wrote the paper. Both authors had approved the final version.

ACKNOWLEDGEMENT

The authors wish to thank Tahere Hendijani.

REFERENCES

- [1] M. Jacobides and S. Billinger, "Designing the boundaries of the firm: From 'make, buy, or ally' to the dynamic benefits of vertical architecture," *Organization Science*, vol. 17, no. 2, pp. 249-261, 2006.
- [2] N. Jones, R. Borgman, and E. Ulusoy, "Impact of social media on small businesses," *Journal of Small Business and Enterprise Development*, vol. 22, no. 4, pp. 611-632, 2015.
- [3] M. Alvani and H. Danaeifard, "Public administration and public trust," *Quarterly Journal of Knowledge Management*, vol. 55, pp. 7-24, 2001 (in Persian).
- [4] W. G. Mangold and D. J. Faulds, "Social media: The new hybrid element of the promotion mix," *Business Horizons*, vol. 52, no. 4, pp. 357-365, 2009.
- [5] A. M. Warren, A. Sulaiman, and N. Jaafar, "Social media effects on fostering online civic engagement and building citizen trust and trust in institutions," *Government Information Quarterly*, vol. 31, no. 2, pp. 291-301, 2014.
- [6] R. H. Wicks, J. L. Wicks, S. A. Morimoto, A. Maxwell, and S. R. Schulte, "Correlates of political and civic engagement among youth during the presidential campaign," *American Behavioral Scientist*, vol. 7, pp. 173-208, 2014.
- [7] H. Chesbrough, "The era of open innovation," *Sloan Management Review*, vol. 44, no. 3, pp. 35-41, 2003.
- [8] H. Chesbrough, "Open innovation: A new paradigm for understanding industrial innovation," in *Open Innovation: Researching a New Paradigm*, H. Chesbrough, W. Vanhaverbeke, and J. West, Eds., Oxford: Oxford University Press, 2006, pp. 1-14.
- [9] E. Huizingh, "Open innovation: State of the art and future perspectives," *Technovation*, vol. 31, pp. 2-9, 2011.
- [10] S. Prokesch, "The sustainable supply chain," *Harvard Business Review*, vol. 88, no. 10, pp. 70-72, 2010.
- [11] H. Chesbrough and A. K. Crowther, "Beyond high tech: Early adopters of open innovation in other industries," *R&D Management*, vol. 36, no. 3, pp. 229-236, 2006.
- [12] T. Salge, M. Farchi, I. Barrett, and S. Dopson, "When does search openness really matter? A contingency study of health-care innovation projects," *Journal of Product Innovation Management*, vol. 30, no. 4, pp. 659-676, 2013.
- [13] J. Bernoff and C. Li, "Harnessing the power of the oh-so-social web," *MIT Sloan Management Review*, vol. 49, pp. 36-42, 2008.
- [14] M. I. Kafourous, "The impact of the internet on R&D efficiency: Theory and evidence," *Technovation*, vol. 26, pp. 827-835, 2006.
- [15] B. Kijkuit and J. V. D. Ende, "With a little help from our colleagues: A longitudinal study of social networks for innovation," *Organizational Studies*, vol. 31, pp. 451-79, 2010.
- [16] W. Ooms, J. Bell, and R. A. W. Kok, "Use of social media in inbound open innovation: Building capabilities for absorptive capacity," *Creativity and Innovation Management*, vol. 24, no. 1, pp. 136-150, 2014.
- [17] M. Mount and M. G. Martinez, "Social media: A tool for open innovation," *California Management Review*, vol. 56, no. 4, pp. 124-143, 2014.
- [18] J. West and M. Bogers, "Leveraging external sources of innovation: A review of research on open innovation," *Journal of Product Innovation Management*, vol. 31, no. 4, pp. 814-831, 2014.
- [19] K. Laursen and A. Salter, "Open for innovation: The role of openness in explaining innovation performance among U.K. manufacturers," *Strategic Management Journal*, vol. 27, no. 2, pp. 131-150, 2006.
- [20] S. Du, G. Yalcinkaya, and L. Bstieler, "Sustainability, social media driven open innovation, and new product development performance," *Journal of Product Innovation Management*, vol. 33, no. S1, pp. 55-71, 2016.
- [21] R. Degen, "Social network driven innovation," Whitepaper No. 47 Glob Advantage Center of Research in Int. Business and Strategy, 2009.
- [22] H. Kärkkäinen, J. Jussila, and J. Väisänen, "Social media use and potential in business-to-business companies' innovation," in *Proc. the 14th International Academic MindTrek Conf.: Envisioning Future Media Env.*, Tampere, Finland, 2010, pp. 228-236.
- [23] F. Piller, A. Vossen, and C. Ihl, "From social media to social product development: The impact of social media on co-creation of innovation," *Die Unternehmung*, vol. 66, no. 1, 2011.
- [24] I. Mergel, "The social media innovation challenge in the public sector," *Information Polity*, vol. 17, no. 3-4, pp. 281-292, 2012.
- [25] E. Loukis, Y. Charalabidis, and A. Androutsopoulou, "Promoting open innovation in the public sector through social media monitoring," *Government Information Quality*, vol. 34, pp. 99-109, 2017.
- [26] E. Hitchen, P. A. Nylund, X. Ferràs, and S. Mussons, "Social media: Open innovation in SMEs finds new support," *Journal of Business Strategy*, vol. 38, no. 3, pp. 21-39, 2017.
- [27] H. A. Linstone and M. Turoff, *The Delphi Method: Techniques and Applications*, MA: Addison-Wesley Educational Publishers Inc., 2002.
- [28] C. Okoli and S. D. Pawlowski, "The Delphi method as a research tool: An example, design considerations and applications," *Information and Management*, vol. 42, no. 1, pp. 15-29, 2004.
- [29] U. G. Gupta and R. E. Clarke, "Theory and applications of the Delphi technique: A bibliography 1975-1994," *Technological Forecasting and Social Change*, vol. 53, no. 2, pp. 185-211, 1996.
- [30] F. Bolger and G. Wright, "Improving the Delphi process: Lessons from social psychological research," *Technological Forecasting and Social Change*, vol. 78, no. 9, pp. 1500-1513, 2011.
- [31] G. Rowe, G. Wright, and F. Bolger, "Delphi: A reevaluation of research and theory," *Technological Forecasting and Social Change*, vol. 39, no. 3, pp. 235-251, 1991.
- [32] F. Hasson, S. Keeney, and H. McKenna, "Research guidelines for the Delphi survey technique," *Journal of Advanced Nursing*, vol. 32, no. 4, pp. 1008-1015, 2000.
- [33] F. Kache and S. Seuring, "Challenges and opportunities of digital information at the intersection of big data analytics and supply chain management," *International Journal of Operation and Production Management*, vol. 37, no. 1, pp. 10-36, 2017.
- [34] W. Revelle, "Hierarchical cluster analysis and the internal structure of tests," *Multivariate Behavioral Research*, vol. 14, no. 1, pp. 57-75, 1979.

Copyright © 2021 by the authors. This is an open access article distributed under the Creative Commons Attribution License ([CC BY-NC-ND 4.0](https://creativecommons.org/licenses/by-nc-nd/4.0/)), which permits use, distribution and reproduction in any medium, provided that the article is properly cited, the use is non-commercial and no modifications or adaptations are made.



Seyed Hamed Ghanadpour was born in Tehran, 1980. He got his Bachelor's degree in computer engineering from Amirkabir University, Tehran and Master's degree in IT engineering from Tarbiat Modarres University, Tehran. Now he is a PhD student in IT management, Shahid Beheshti University, Tehran, Iran.

He is the CEO and board member of eFarda Company, which has more than 15 million Dollars Registered Capital. He also teaches Fundamentals of Information Technology and Business Development in Tehran universities from 2005 till now.

Mr. Ghanadpour has established IT management in Master's degree in Amirkabir University. Some of his publications are:

R. Rouzbahani and S. Hamed Ghanadpour, "Knowledge management in computer-aided process planning: The role of hybrid manager," IRIMC 2012.

S. Hamed Ghanadpour, "Mobilizing intelligent CRM: A new approach to customer relationship management," ECDC 2012.