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How faculty members share scientific information via social media: Factors and barriers

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Abstract

This study aimed at identifying the most important factors and barriers to sharing scientific information via social media among Iranian faculty members. A review of the literature on sharing scientific information made it possible to identify some of the factors and barriers to sharing such knowledge. The mixed methodology was used in this study combining qualitative and quantitative methods. The data were collected using online questionnaires. In general, three factors affecting information sharing in the academic environment were identified: organizational culture (including favorable environment for debating, kind of valued information, communication, mutual responsibilities, power distribution and recognition and reward), individual characteristics (including mutual trust, common language, individual time management) and organizational structure (including hierarchy, relationship network, knowledge storage, the transmission of knowledge and type of training for the task). Moreover, four information-sharing barriers were identified and classified in the following categories: individual differences, individual perception of sharing costs, lack of time, lack of recognition and reward, the vision of others, preference for explicit knowledge and resource and infrastructure.

Keywords: information sharing, social media, scientific information, faculty members.

I. INTRODUCTION

The use of social media has increased dramatically over the past two decades [1, 3, 37]. Nowadays, various social media platforms and apps have emerged as important communication channels that allow people to connect online and share information with others. Social media has become ubiquitous all over the world [4, 15]. Only organizations that are in line with rapid changes in the environment and accept the high-quality standards compete with each other and take steps to achieve the goals and the vision and mission of their organization. The success rate of organizations like universities, in achieving their goals and mission, greatly depends on their ability to optimally use and activate organizational information so that they can provide organizational learning and sustainable development skills for their employees [38, 42]. In organizations like universities, information sharing is of high importance, but it is not very common among their staff members [39, 40].

Importantly, some studies show that creating a culture and encouraging faculty members to share information is not an easy task [44, 45]. Therefore, this study aimed to identify the most important factors and barriers to sharing scientific information via social media among Iranian faculty members while reviewing the literature. A few studies have been conducted on sharing information and knowledge in the scientific environment, but numerous studies in this regard have been conducted in public and private organizations. A case study of information sharing in universities will enable faculty members to become more empowered and outperform in the face of the real needs of society and solve the problems of society.

II. THEORATICAL FRAMEWORK

A. Sharing information via social media

The use of social media has changed many aspects of everyday life. Over the past few years, access to iwnformation through smartphones and social media has tremendously increased [2]. The use of social media has become an integral part of organizations, such as universities and affects all aspects of their work. Thus, social media are powerful tools that allow people, including faculty members, to share or understand (and interpret) experiences and scientific or personal information [41, 43, 7].

Some studies have shown that the use of social networking sites to share scientific information and engage the target audiences can have positive results [11, 20, 22], but there are some uncertainties in this regard. One of these uncertainties about the usefulness or harmfulness of using social media is the credibility of both shared information and the source of information. One study demonstrated that information source credibility is an important factor that

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can lead to effective or ineffective use of information shared through social media [49].

Therefore, the capabilities of social media have made it possible to facilitate the process of information sharing in organizations [2]. Using social media, faculty members within an organization, in addition to sharing explicit knowledge through written communication, can also share tacit knowledge of themselves and their organization, which is difficult to transmit through written communication [11]. Accordingly, knowledge sharing via social media will be more efficient [18].

B. Factors affecting the sharing of scientific information

Employees within an organization interact with each other based on the context of organizational culture (OC). Therefore, the OC can determine the type of information sharing of members of the organization [19]. Furthermore, one of the critical success factors of organizations is the creation of OC that encourages and reinforces the knowledge-sharing behaviors and would be useful for their members [8]. Based on [22], OC can be defined as a unique system in which specific values and behaviors are shared by the members of an organization. Therefore, OC plays a decisive role in sharing scientific information because it serves as the infrastructure for information sharing. They considered it important to change the approach of organizations, in which employees are encouraged to share scientific information through reward systems.

Moreover, the personal dimensions of the employees and managers such as reflection, internalization, experience and talent are of equal importance for the type of information sharing. In particular, individuals at the head of organizational knowledge structure [10] can play an important role in sharing scientific information. According to [40], a company's information can be kept up to date by hiring new people who have specific skills, abilities and knowledge and gradually sharing their knowledge. Also, [29] found that the more individuals are open to others, the more likely they are to be willing to share information. Due to their self-confidence, these people often communicate with other employees and this can improve the commitment of other employees to the organization and create a knowledge-sharing culture.

Aside from the fact that an organizational structure (OS) encourages employees to share information or prevents them from sharing information [6], sharing information should be considered inherently important and decisive. Therefore, an OS needs to be flexible enough to encourage employees to share scientific information. Organizations with less formal and more flexible structures are more inclined to share information and knowledge [40, 41].

Additionally, individual characteristics (IC) such as interpersonal skills, temperament and attitude make it difficult to share information [5]. In particular, some of the faculty members avoid sharing information because their position may be undermined. Some other personal barriers to sharing scientific information include the level of education, age, sex, position and work experience.

TABLE 1. Identified factors and barriers from the related literature

Dimensions	Components	Indicators	Main references
Factors	Organizational culture	Favorable environment for debating	4, 8, 19, 35, 56
		Kind of valued information	7, 15, 23, 35, 42, 54
		Communication	9, 16, 20, 28, 42, 58
		Mutual responsibilities	3, 11, 16, 32, 49, 62
		Power distribution	2, 12, 29, 43, 52, 61
		Recognition and reward	1, 5, 18, 23, 39, 47, 54, 59
	Organizational structure	Hierarchy	6, 16, 27, 35, 41, 64
		Relationship network	12, 20, 22, 36, 38, 47, 56
		Knowledge storage	11, 13, 24, 28, 36, 49, 60
		Transmission of knowledge	9, 15, 27, 39, 49, 55, 57, 64
		Type of training for the task	10, 14, 29, 33, 44, 50
	Individual characteristics	Mutual trust	17, 27, 30, 41, 45, 53
		Common language	2, 8, 12, 17, 25, 36, 40, 42, 49, 51
		Individual time management	1, 6, 11, 18, 21, 35, 40, 41, 46, 50, 65
Barriers	Communication barriers	Communication	3, 4, 6, 15, 17, 22, 31, 40, 49, 63
	Technological barriers	Technology	4, 6, 8, 12, 13, 19, 26, 37, 53, 63
	Personal barriers	Personal differences	1, 3, 8, 13, 14, 20, 25, 34, 47, 50, 61
		Sharing costs	5, 9, 17, 28, 33, 54, 56
		Lack of time	2, 5, 9, 17, 22, 29, 37, 42, 48, 52, 53, 59, 61
		Lack of recognition and reward	3, 8, 17, 22, 36, 37, 42, 58, 60
		View of the others	4, 9, 15, 28, 36, 54, 55
		Preference for explicit knowledge	10, 16, 24, 33, 44, 47, 59, 63
	Barriers of resources and structures	Preference of the formal and structure	13, 17, 28, 48, 52, 62
		Physical and material resources	18, 26, 37, 49, 53, 61

C. Barriers to sharing scientific information

In addition to identifying the factors affecting the sharing of scientific information, it is also necessary to consider the barriers to sharing this type of information and

their various causes and origins. Identifying barriers to the sharing of scientific information is an important factor in the success or failure of an organization's strategic management policies [48]. Many different potential barriers are classified into the following categories: personal barriers, resource and infrastructure barriers, communications and technology.

It has become clear that effective oral or written communication is essential for operational information sharing so that its absence can create barriers. Another barrier to sharing scientific information is the lack of communication and interaction between information sources and recipients [48]. Organizations with bureaucratic and hierarchical characteristics can create another barrier. These types of organizations are usually inflexible, which can be considered as a barrier to communication between the members of the organization. Some researchers, such as [19], believed that high turnover of staff, limited access to resources, lack of transparency, lack of experienced staff and lack of internal competitiveness can create barriers to good communication.

Mohajan changed the way organizations operate as it has provided means to instant access to information and data over long distances [37]. However, the technology itself can also be regarded as a challenge, meaning that sometimes technology makes it difficult to use and manage how information is shared. Some researchers, including [7] argued that organizations that only invest in information and communication technology systems are over-reliant on this technology and invest little in the individual knowledge of their employees, which can undermine the management of tacit knowledge.

A set of technological barriers to information sharing was identified by [47], including insufficient technology to meet the required tasks, the inadequacy of technology to meet the needs of staff, which in turn meet the needs of the faculty members, the difficulties in using technology, the inability of technology to improve the organization's performance and poor tech support to protect technology.

Lack of proper understanding of the importance of information that a person has and not having enough understanding of how much this information can help others because of their need for this information are considered as other barriers to sharing information [21]. According to [36], the differences in culture of origin, race and value systems should also be regarded as personal barriers. Likewise, the lack of a reward and recognition system for people who share information can lead to a discouraging culture in the organization and their unwillingness to share information. Similarly, the inability to trust or distrust others creates interpersonal relationships that ultimately prevent the sharing of scientific information [14].

Organizing and dividing the different departments of the university based on the administrative hierarchy prevents the development of intimate close relationships between its staffs. It is necessary to define work processes in such a way as to provide enough space for people to be able to produce information and share it after identifying useful and important information. Hence, the lack of formal and informal relationships between faculty members creates barriers to the sharing of scientific information via social media [1, 4]. Factors and barriers to the sharing of scientific information identified in the literature are shown in Table 1.

III. METHODOLOGY

The mixed methodology was used in this study combining qualitative and quantitative methods. The use of mixed methods research in impact evaluation has shown that this methodology provides a broader spectrum of ways to better understand complex research problems in different contexts than could be done through either quantitative or qualitative approaches alone.

In this study, the factors and barriers to sharing scientific information were extracted from the existing literature. A questionnaire based on these factors and barriers to sharing scientific information was developed to determine faculty members' attitudes toward the importance of each of these factors and barriers. Therefore, the objective of each item was to assess the degree of agreement on a factor or barrier to the sharing of scientific information. Respondents were the faculty members who anonymously and voluntarily agreed to complete the online survey through Google Forms in August 2021.

A total of 120 faculty members of Shahid Beheshti University completed the survey. To assess the validity of the questionnaire, a pretest was conducted with 32 faculty members of the Education and Psychology Department of Shahid Beheshti University. After the data were collected from 120 respondents, the reliability (internal consistency) of the related factors and barriers was calculated using Cronbach's alpha. Then, to obtain the integration between the data using the exploratory factor analysis technique, the data were grouped into different factors. Thus, the leading factors and a group of barriers to the sharing of scientific information among the faculty members were classified.

The Kaiser-Meyer-Olkin (KMO) test is used along with Bartlett's test of Sphericity, a different test that examines whether the data are normally distributed. So, Bartlett's test of sphericity and KMO test were employed to confirm the sampling adequacy of data used for Factor Analysis. Principal Component Analysis (PCA) based on the correlation matrix was used to find a minimum number of factors matching the maximum data variance. Using the latent root method, the minimum number of factors related to the indicators was proved using Eigenvalues in such a way that only factors with Eigenvalues greater than 1 were retained and the rest were removed. To separate the factors and barriers more clearly, the Varimax orthogonal rotation was used to simplify the columns of the factor matrix.

IV. RESULTS

A. Factors of scientific information sharing via social media

After performing the factor analysis on the data obtained from the questionnaires, the factors affecting the sharing of scientific information were identified (Table 2).

TABLE 2. Rotated matrix of the factors

Indicators	Factors		
	OC	IC	OS
11. Favorable debate environment	0.736		
12. Kind of valued information	0.721		
13. Communication	0.666		
14. Mutual responsibilities	0.591		
10. Power distribution	0.537		
8. Transmission of knowledge	0.535		0.503
6. Recognition and reward	0.451	0.418	
3. Mutual trust		0.793	
2. Common language		0.760	
1. Individual time management		0.754	
5. Hierarchy			0.791
4. Relationship network		0.469	0.637
9. Knowledge storage			0.624
7. Type of training for the task	0.538		0.557

In this study, an optimal OC, which was identified as the first factor affecting the sharing of scientific information via social media, is a favorable environment for debating and scientific information exchange. In such an environment, the faculty members openly and fearlessly acknowledge their ignorance and constructive criticism is easily accepted. In such the OC, the most prevalent forms of communication are developed and the type of information, employees' skills and even their intuitions, lack of standard training and lack of distinction between employees are highlighted and thus, the dominant method of communication in the organization will be logic and rationality.

Promoting or preventing interactions between individuals and employees is rooted in OC. The reciprocal responsibilities of individuals to achieve organizational goals are closely related to the form and type of relationship they have with each other. In-game environments where there is the interaction between people via teamwork and the possibility of trial and error, sharing scientific information is also easier. Providing virtual environments such as access to social media or holding remote meetings can also be linked to an organization's culture. A particular OC which is usually affiliated with power centers may require employees not to have access to rare information or impose strict bans on organizational information dissemination.

Even though the information is available to people, the OC can play a more prominent role in the transmission or sharing of information. Thus, information sharing is rooted in the OC rather than individual preferences or organizational tasks and also the OC is more about facilitating people's interaction with each other than it is about storing and coding information. Instead of dictating the sharing of scientific information by the OS, a recognition and reward system can be designed for those who share scientific information. This is part of the OC. Although the individual motivation of faculty members in sharing information is one of the most influential factors in the IC, the existing OC can encourage the faculty members to share their information.

The second factor affecting the IC, which consists of several indicators, is related to the intrinsic motivation of the individual. Therefore, the intrinsic motivation of the faculty members to build a sense of mutual trust can be led to better information sharing. The fewer faculty members feel about sharing scientific information with risk and uncertainty, the greater their ability to develop secure and stable relationships between them and the university. In this regard, where it is difficult to express one's inner feelings and experiences, the use of common language will be more important. In other words, because each sender and receiver of scientific information has personalized and internalized this information, the acceptance of a language that uses the same terms and words is very important and creates harmony between the sender and receiver of information.

Regarding OS, the faculty members operate based on revolutionary logic, where the hierarchy is a pyramid OS. Therefore, bureaucracy and formality can create barriers to information sharing. The existence of such a structure creates some behaviors that prevent the proper exchange of experiences and information because, in this structure, the faculty members usually seek to achieve their goals instead of trying to achieve the general goals of the university. Indicators and factors affecting the sharing of scientific information are shown in Figure 1.

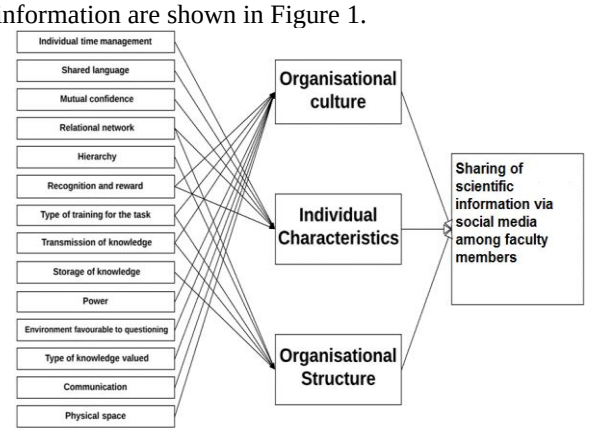

Fig. 1. Indicators and factors of scientific information sharing

B. Barriers to scientific information sharing via social media

Considering the barriers to sharing scientific information identified in the literature and using factor analysis, the four main barriers to the sharing of scientific information via social media among faculty members were finally analyzed (Table 3).

TABLE 3. Rotated matrix of the barriers

Barriers	Components									
	1	2	3	4	5	6	7	8	9	10
Insufficient or non-existent communication	0.731									
Internal competitiveness	0.712									
Hierarchical structure	0.702									
Lack of benefit communication	0.679									
Size of organization	0.570									
Need for cultural change	0.511									

Barriers	Components									
	1	2	3	4	5	6	7	8	9	10
The low retention rate of knowledge	0.508									
Different levels of experience	0.441		0.439							
Shortage of time for contacts	0.437									
IT inadequate to internal communication		0.807								
IT inadequate to the needs		0.800								
Insufficient technical support		0.770								
Insufficient IT		0.758								
IT with no potential for better performance		0.692								
IT difficult to use		0.545								
Different cultural origins			0.802							
Different genres			0.770							
Different levels of schooling			0.571							
Different generations or ages			0.530							
Different languages			0.481							
Information overload				0.719						
Extra and intrusive activity				0.703						
What I do leads to the absence of sharing				0.496						
Time to meet needs					0.863					
Time to share					0.858					
I do not recognize the advantages						0.660				
Lack of recognition and reward						0.605				
I do not like other faculty-related infrastructures							0.709			
Trust in the knowledge of others							0.437			
Lack of access to social media								0.763		
Privilege to documentary support								0.576		
Incompatible with university objectives								0.409		
Strong sense of hierarchical structure									-.593	
I'm afraid to share									0.516	
Difficulty in interpersonal communication									0.497	
Lack of resources and infrastructures										0.834

Inadequate or non-existent communication between people was the first and most important barrier identified in this study. According to many researchers such as [47] in organizations like universities, both written and verbal communication, including the interaction of faculty members with each other to share scientific information are vital. Accordingly, the lack of such communication can be considered as a barrier to the sharing of scientific information. In the university where the hierarchy is based on a pyramid OS and the relatively inflexible and bureaucratic relations between individuals, internal competitiveness can be regarded as a barrier to the sharing of scientific information rather than being constructive.

Another barrier to the sharing of scientific information can be linked to the hierarchical structure of the university. Thus, creating the physical space between the upper and lower levels of the hierarchical structure of the university reduce the interaction between the faculty members. It is usually the case that people who have a lot of work experience but are not scientifically and theoretically powerful will be less inclined to communicate. Maintaining the physical space between faculty members communicating with each other, in turn, can weaken the sharing of scientific information. Another barrier to the sharing of scientific information identified in this study is that faculty members are unaware of the benefits of such a relationship and the sharing of scientific information.

Another obstacle identified is resistance to cultural change. The culture in a university can be compared to the spirit of that university and what emanates from that spirit can be led to the realization of the organizational mission. The fulfillment of the university's vision mission and objectives can be obtained through an emphasis on profitability, customer satisfaction, investing in Research and Development (R&D), etc. To overcome such a barrier, a culture of communication among faculty members can be created or changed by providing the logic of information sharing and the importance of such communication.

The closeness of faculty members to each other, whose scientific and work experiences are very different from each other, is another barrier to the sharing of scientific information. For example, a person with more work and scientific experience may feel that having a relationship with a novice who has little scientific experience is not beneficial for him/her. This is while the novice faculty members communicating with more experienced professors can significantly improve their academic performance and consequently the academic level of the university.

Technological barriers (mentioned in the second component (Table 3) were the second barrier identified in this study. Such a barrier arises from the various types of barriers, such as insufficient IT, insufficient technical support and IT inadequate to internal communication.

Personal barriers were the third barrier identified in this study, which can be based on faculty members' characteristics, perceptions, feelings, or desires. In the present study, six subtypes of personal barriers were identified: individual differences, individual perception of sharing costs, lack of time, lack of recognition and reward, the vision of others preference for explicit knowledge (from the third to the seventh component, respectively).

Therefore, the first personal barrier was individual differences that are based on various factors, such as the different cultural origins and differences in gender, level of experience, level of education, generations, age and even the capabilities and limitations of the dialect of individuals. [41] demonstrated that different cultural origins were considered as a barrier to information sharing because individual differences and the different cultural origins, in turn, entail a set of different values, principles and practices that may not necessarily be consistent with the goals and mission of the university.

Sveiby and Simmons identified differences in sex, level of education, generation and age as potential barriers because these differences can be led to different attitudes, tastes, expectations, or commitments, which in turn can create a barrier to communication between people in the organization [52]. Terpstra and David [54]also showed that the above-mentioned individual differences could also

limit the sharing of information in academic environments such as universities. In this study, individual differences were considered as a barrier to information among the faculty members.

The second subtype of the personal barriers is the individual perception of sharing costs of scientific information. This means that sharing scientific information can be considered as an extra or intrusive activity or his action to share information will not be useful and practical. In such a case, people usually stop trying and do not take action to share scientific information.

The lack of time was the third personal barrier to the sharing of scientific information, i.e., the lack of time, either to share information or to identify the people to whom this information is to be sent. Lack of recognition and reward was the fourth personal barrier to the sharing of scientific information, meaning that lack of awareness of the benefits of sharing scientific information and that their activity in sharing information may not be recognized by university officials or no reward system designed for it. It can eventually discourage faculty members from sharing information, resulting in their withdrawal from such activities.

The vision of the others was the fifth personal barrier to the sharing of scientific information. Each faculty member may be more or less willing to republish scientific information, depending on his or her characteristics as well as the type of reaction that his or her colleagues have shown to information shared in the past and previous cases. The preference for explicit knowledge was the sixth personal barrier to the sharing of scientific information. This means that the faculty members' preference for the sharing of scientific information is more via social media or other forms of written communication than through face-to-face interaction. Accordingly, social media can reduce face-to-face contact. This is while cooperation through face-to-face contact can be defined as one of the important academic missions to achieve scientific goals.

Resource and infrastructure was the last type of barriers to the sharing of scientific information. Resource and infrastructure barriers ranging from the ninth component (formal wisdom and structure) and the tenth (resources and material) are listed in Table 3. Resource and infrastructure consisted of the following barriers: I'm afraid to share, difficulty in interpersonal communication and a strong sense of hierarchical structure. The existence of such a hierarchical structure, in turn, makes some faculty members afraid to share information. According to [13] the rigid hierarchical structure can be defined in such a way that it is not possible to learn through trial and error; therefore, in such an environment, the error is made by the sub-ordinates will not usually be imposed by the superior.

The resource barrier, also identified in [18] means that despite conflicting responsibilities or ideas among the faculty member and university officials, an environment of favorable information sharing can be created. Although this seems very ideal, schematic representation of these barriers can help us to understand the facts and try to overcome these barriers to the sharing of scientific information, as shown in Figure 2.

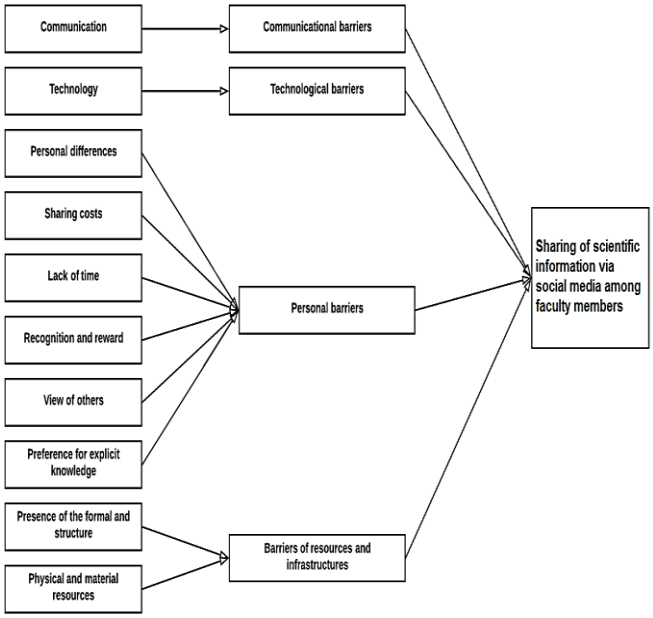

Fig. 2. Barriers to scientific information sharing

V. CONCLUSION

According to the purpose of this study, it can be found that indicators, such as relationship network, type of training for the task, transmission of knowledge and recognition and reward could also be related to two out of the three identified factors, indicators of the sharing of scientific information were related to at least one factor. In this study, 14 general indicators affecting the sharing of scientific information were identified and classified under three general factors using factor analysis. Barriers to the sharing of scientific information among faculty members can be divided into four major types: communication barriers, technological barriers, personal barriers and resource and infrastructure barriers. Individual differences, individual perception of sharing costs, lack of time, lack of recognition and reward, the vision of others and preference for explicit knowledge, were regarded as personal barriers. In addition, resource and infrastructure barriers included formal wisdom and structure and resources and material.

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