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Prioritizing Different Types of Barriers to Knowledge Sharing: A Cause-and-Effect Analysis of the Views of Academics in Turkey

Bilgi Paylaşımının Önündeki Çeşitli Engellerin Önceliklendirilmesi: Türkiye'deki Akademisyenler Üzerine Neden-Etki Araştırması

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Özet

Bu çalışma, Türkiye'deki akademisyenler arasında bilgi paylaşımının önündeki çeşitli engel türlerini belirlemeyi ve engeller ile etki dereceleri arasındaki ilişkileri incelemeyi amaçlamaktadır. Bu doğrultuda, nitel ve nicel yaklaşımlar iki aşamada kullanılmaktadır. İlk aşamada, literatür taraması ile bilgi paylaşım engelleri belirlenmiş ve Türk akademisyenlerin önündeki mevcut engelleri saptamak üzere uzman görüşleri ile belirlenen engeller organizasyonel, bireysel ve teknolojik boyutlar altında kategorilendirilmiştir. İkinci aşamada ise, tanımlanan engeller ve etkileşimleri, Yorumlayıcı Yapısal Modelleme (ISM) ve Karar Verme Deneme ve Değerlendirme Laboratuvarı (DEMATEL) yöntemleriyle ayrıntılı olarak incelenmiştir. Araştırmanın bulguları, örgütsel ve bireysel bilgi paylaşım engellerinin teknolojik engellerden daha etkili olduğunu ortaya koymaktadır. ISM ve DEMATEL bulgularına göre, "kurumsal yapı", "güç ilişkileri" ve "destekleyici kurum kültürü" Türkiye'deki akademisyenler arasında bilgi paylaşımının itici güçleridir. Bu çalışma, hem akademik bilgi paylaşımını teşvik etmek için gerekli eylemleri gerçekleştirmeyi hem de üniversitelerin performanslarını geliştirmeyi sağlayabilecek hiyerarşik ve nedensel bir ilişki modeli sağlamaktadır. Bulgular, akademisyenlerin bilgi paylaşım engellerinin aşılabilmesi için temel engellerin neler olduğu ve birbiriyle nasıl ilişkili oldukları konusunda yararlı bilgiler sunmaktadır. Dolayısıyla, sunulan bulgular hem akademik camiaya hem de düzenleyici eylemleri gerçekleştirmekten sorumlu politika yapıcılara katkıda bulunma konusunda önemli potansiyeller barındırmaktadır.

Anahtar sözcükler: Akademisyenler, bilgi paylaşım engelleri, bilgi paylaşımı, bilgi yönetimi.

Abstract

This study aims to identify different types of barriers to knowledge sharing among academics in Turkey and to investigate the relationships between the barriers and their degree of impact. Accordingly, it implements qualitative and quantitative approaches in two phases. In the first phase, the knowledge sharing barriers are identified through the literature review and categorized under organizational, individual, and technological dimensions via expert opinions so as to determine current barriers for the Turkish academics. In the second phase, the identified barriers and their interactions are more deeply investigated by using the Interpretive Structural Modeling (ISM) and Decision Making Trial and Evaluation Laboratory Method (DEMATEL) methods. The findings of the study reveal that organizational and individual knowledge sharing barriers have a stronger effect than technological barriers. According to ISM and DEMATEL findings, "corporate structure", "power relations"", and "supportive corporate culture" are the driving forces for the knowledge sharing among the academics in Turkey. This study provides a hierarchical and causal relation model that may enable both performing the actions needed to promote academic knowledge sharing and advancing university performances. The findings offer useful insights on what the key barriers are and how these interrelate, so that they can be overcome. Thus, the findings hold significant potential to contribute both to the academic field and to the policymakers who are in charge of taking regulatory actions.

Keywords: Academics, knowledge management, knowledge sharing, knowledge sharing barriers.

Knowledge is derived from the necessity of shaping the world around people, classifying it, and interpreting this world. In other words, it aims to reduce uncertainty in people's lives (Uit Beijerse, 1999). Universities are knowledge-intensive organizations. The main reason for the existence of universities is knowledge creation and sharing.

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Thani and Mirkamali (2018) emphasize that in academia, the construction of knowledge is realized through education and research. Furthermore, knowledge creation is an important tool for universities to manage changes (Hautala, 2011) and contributing to societal progress and development (Tian, Nakamamon, & Wierzbicki, 2009). However, since the relation between good governance and good knowledge becomes central (Blackman & Kennedy, 2009), sharing the produced knowledge to realize their mission becomes essential for universities (Al-Kurdi, El-Haddadeh, & Eldabi, 2018; Kehm & Teichler, 2007). Furthermore, in addition to their role in supporting the learning through teaching and research training programs, universities also have an important position for sharing knowledge by means of working with businesses and other organizations to assist innovation, and social and cultural enterprise (Fullwood, Rowley, & Delbridge, 2013). In this sense, Charband and Navimipour (2018) suggest that academia should foster both knowledge creation and knowledge sharing.

Knowledge creation can be conceived as the beginning of the knowledge management process and without sharing the created knowledge, it is impossible to get good results. Therefore, managing and sharing knowledge is a source of competence for universities (Champard & Nvimipour 2018; Dehghani, 2019) due to the importance of knowledge sharing in mutual learning, intellectual development of students, reducing redundant learning efforts, and creating innovation. With the help of effective knowledge sharing within and between universities, several positive effects can be observed: concentration in certain areas on research subjects can be avoided, every piece of new valuable knowledge can be reached in a short time, and a more effective synergy environment can be created (Kalkan, 2004).

Despite the importance of the knowledge creation and sharing, Fullwood et al. (2013) concluded that research on knowledge management is very limited. In this respect, Charband and Navimipour (2018) suggest the importance of examining knowledge sharing and identifying knowledge sharing barriers in universities. Although some studies have identified knowledge sharing barriers in the university context (e.g. Hew & Hara, 2007; Jain, Sandhu, & Sidhu, 2007; Kim & Ju, 2008; Santosh & Panda, 2016; Sohail & Daud, 2009; Tahir, Musah, Abdullah, Musta'amal, & Abdullah, 2016; Wang, Wang, & Wang, 2010; Yassin, Salim, & Sahari, 2013; Zawawi et al, 2011), none of them have examined the relationship between knowledge sharing barriers.

It is critical to investigate the barriers of knowledge sharing among academics, to construct a systematic model of the relations between these barriers, and to come up with a strategic roadmap to overcome these barriers. More particularly, to achieve these objectives, it becomes a requisite to use a robust and realistic multi-criteria decision making tool, such as the Interpretive Structural Modeling (ISM) method. In the literature, there are several studies in which knowledge sharing barriers in various sectors are examined by applying the ISM method (e.g. Joshi, Parmer, & Chandrawat, 2012; Sharma & Singh, 2013a; Sharma, Singh, & Neha, 2012); however, there is a lack of research on the relation and interaction of knowledge sharing barriers between academics by employing decision making techniques, especially through the ISM and the Decision Making Trial and Evaluation Laboratory Method (DEMATEL) methods.

Thus, by means of focusing on knowledge sharing, which is the key element of knowledge management implementation, this research aims to determine the current knowledge sharing barriers for Turkish academics and reveal the relationships between the identified barriers and their degree of impact. Therefore, the research questions of this study are; *(i)* What are the barriers to knowledge sharing among academics in Turkey? *(ii)* What are the interactions and directional relations among the identified knowledge sharing barriers for Turkish academics?

The remainder of this study is organized as follows: In the following section, the literature on knowledge management, knowledge sharing, and their importance in universities is reviewed. In the Methods section, the research method consisting of two phases is detailed. The Results section presents the findings related to current knowledge sharing barriers obtained from the expert opinions and the ISM and DEMATEL results which include hierarchical and causal relationships among barriers. The results are compared and contrasted with the previous studies in the Discussion section including the academic and practical contributions. In the final section of the study, the limitations are explained and further research directions are proposed.

Conceptual Framework

Knowledge management is the formation of strategies and processes which includes the planning, organizing, motivating, and controlling of people, processes, and systems in the organization to ensure that its knowledge-related assets are effectively used (King, 2009, p. 4). In addition to its position in knowledge management processes, knowledge sharing is one of the main contributing factors to organizational competitiveness (Fernie, Green, Weller, & Newcombe, 2003).

According to Ruggles (1997), knowledge management consists of three processes which are creation, acquisition, and synthesis (or adaptation) of knowledge, respectively. From a broader perspective, Liebowitz and Beckman (1998) state that knowledge management processes are gathering, separating,

selecting, organizing, storing, sharing, and implementing the knowledge. Without knowledge sharing, which is the last and important stage of knowledge management, acquiring or creating more and more new knowledge alone can not make any organization successful, and the application of knowledge can not be possible. Therefore, the acquisition, sharing, development, and management of knowledge among the members of the organization is seen as a strategic activity, which further increases the importance of knowledge sharing (Chahal & Savita, 2014; Demirel, 2007).

Universities, where the majority of employees are knowledge workers, can be regarded as knowledge-based organizations in which knowledge sharing has a significant importance. Effective knowledge sharing at universities enables academics to realize and develop their potential. The created or gained knowledge by the academics constitutes the storehouse of the educational institution's intellectual capital (Jain et al., 2007, p. 23). Knowledge accumulation allows universities to match existing skills and experience with existing needs to fill the gaps or shortcomings in the knowledge base (Cheng, Ho, & Lau, 2009). Cheng et al. (2009) suggest that when knowledge management is used in an effective way, it can create a competitive advantage within academic institutions as in commercial organizations. The creation of intellectual capital with the created and stored knowledge may help academics and researchers to improve their knowledge cycle and make a difference in the academic community. When the produced knowledge in universities is shared with technoparks, entrepreneurship offices and other related interests, it may also create a competitive advantage for companies.

Universities are expected to be places where academics share their knowledge easily and freely. Ideally, academics should recognize the importance of knowledge sharing and share knowledge with their colleagues in their daily activities. However, knowledge sharing in universities is less common than expected, and also low willingness or unwillingness to share knowledge is seen as a problem in the academic field (Ramayah, Yeap, & Ignatius, 2013). Kim and Ju (2008, p. 282) state that academics tend to be independent and individualistic by placing more emphasis on individual academic achievement rather than sharing common views regarding the aims of the university. Similarly, Fullwood et al. (2013) argue that the individualistic culture in universities is a significant difficulty for their knowledge-sharing process. Considering the missions of universities such as discovering, producing, protecting, and disseminating knowledge, it is important to provide a systematic structure and knowledge sharing opportunities that will help academics to share their knowledge and cooperate effectively.

When the related literature is examined, it is seen that there are various studies about the barriers in knowledge sharing (Table 1).

Table 1. Major studies related to knowledge sharing barriers in literature.

Authors	Contribution of the study
Riege (2005)	Classification of potential knowledge sharing barriers ito three main domains; individual, organizational, technological.
Lindsey (2006)	Richer set of potential barriers to knowledge sharing derived from the communications literature.
Rosen, Furst, & Blackburn (2007)	Six common barriers to knowledge sharing in virtual teams are: lack of trust, time constraints, technology constraints, team leader constraints, failure to develop a transactive memory, cultural constraints.
Ardichvili (2008)	Barriers to online knowledge sharing include interpersonal factors, procedural and/or use of technology-related factors, and cultural norms.
Joshi et al. (2012)	Two barriers, which are lack of top management commitment (organizational barrier) and inadequate understanding of knowledge management have high driving power and therefore require attention.
Sharma et al. (2012)	Lack of top management commitment and inadequate understanding of KM are two barriers against the knowledge sharing.
Assefa, Garfield, & Meshesha (2013)	Organisational and individual factors are the main barriers to knowledge sharing in commercial banks.
Sharma & Singh (2013a)	Apprehension or fear that sharing knowledge may reduce job security and low awareness by others of the value and benefits of pos sessing knowledge are the most important individual knowledge sharing barriers in engineering industry
Sharma & Singh (2013b)	The organizational knowledge sharing barriers have the maximum effect on knowledge sharing followed by technological and indi vidual barriers.
Jeenger & Kant (2013)	Knowledge sharing barriers are categorized into strategic, organisational, financial, technological, individual and social-cultural. Three most significant barriers are strategic and organizational.
Olaniran (2017)	The knowledge sharing barriers are categorized into personal, team, organizational, and external barriers.

In addition, there are some studies conducted with teachers or academics in the education sector, where the importance of knowledge sharing is quite high. For example, Jain et al. (2007) examined the barriers to sharing knowledge in an academic environment by using the survey method in Malaysia Business Schools. Chong, Yuen and Gan (2014) investigated the knowledge sharing barriers and strategies of academic staff in public and private universities in Malaysia based on the study of Jain et al. (2007). Kim and Ju (2008) concluded that perception and reward systems are the most influential factors in faculty knowledge sharing by surveying full-time academic staff at a private research university in South Korea. Sohail and Daud (2009) state that the nature of knowledge, the working culture, the attitude of the staff, the motivation to share, and the opportunity to share play an important role in increasing knowledge sharing among academic staff in public universities.

Zawawi et al. (2011) conclude that the strongest factors affecting knowledge sharing are the lack of organizational rewards which is followed by a lack of information communication technology. The most important barriers perceived by the academic staff as determined by Santosh and Panda (2016) are lack of appreciation and the absence of an organizational knowledge sharing culture. Tahir et al. (2016) state that the reward system and culture are important predictors of teachers' knowledge sharing in technical learning institutions. In addition, they report the lack of management support and individual negative perceptions as the constraints teachers face in sharing their knowledge. Yeşil and Hırlak (2013) carried out a survey study with academics at a university in Turkey and concluded that individual knowledge sharing barriers had a negative impact on individual innovation behavior. Al-Kurdi et al. (2018) examined the knowledge sharing at higher education institutions through a systematic literature review from the individual, organizational, technological, and cultural perspectives, and found that the majority of determinants of knowledge sharing are related to individual factors followed by organizational and technological factors.

Table 2 shows the details of the literature review related to knowledge sharing in the academy. Knowledge is a valuable power in the academic community and this power increases when shared. Sharing knowledge among academics with different experiences, values, and opinions is also important in achieving the strategic goals of universities and increasing their performance.

Method

This research is conducted in two phases and the flow of the research is presented in Figure 1. ISM, which is used to define and clarify the factors that cause a problem and their relations to each other, is an interactive planning method that is structured with a comprehensive systematic model of the factors related to one another (Saatçioglu & Özmen, 2010). Following the identification, the weights and the importance ranking of the criteria can be determined through the DEMATEL method (Karaoğlan & Şahin, 2016). As in this research, the ISM and DEMATEL methods have been used together in several studies in different fields to obtain better findings (e.g. Chauhan, Singh, & Jharkharia, 2016; Chuang, Lin, Chen, & Chen, 2013; Mehregan, Hashemi, Karimi, & Merikhi, 2014; Wang, Cao & Zhou, 2018; Yin, Wang, Teng, & Hsing, 2012). Using the DEMATEL and ISM analysis techniques together is more functional than using a single technique when there are dependencies between factors.

The DEMATEL technique is based on the graph theory and examining complex relationships with the help of quantitative methods (Shao, Taisch, & Ortega-Mier, 2016). It transforms the cause-effect relationship between the factors into a visual structural model and provides a better understanding of the nature of the subject (Chuang et al., 2013) since it takes into account the interdependencies among factors within a system (Menteş, Akyıldız, & Helvacıoğlu, 2014). The ISM analysis not only identifies priorities between factors, but also provides information about hierarchical relationships between sub-factors (Yudatama, Hidayanto, & Nazief, 2018). Thus, the ISM method defines the context of the relationship by using dependencies and driving powers of the factors (Luthra, Garg, & Haleem, 2015). Therefore, the integration of DEMATEL and ISM methods is more useful than some other techniques, such as AHP and TOPSIS, since these are insufficient to consider the indirect effect between factors and assume that the factors are independent (Patil & Kant, 2014). By integrating the DEMATEL and ISM methods, besides analyzing the criteria, their internal relationships can also be evaluated. It can be said that the DEMATEL method is more micro-oriented and the ISM model is more macro-oriented, since DEMATEL offers a deeper and more complex evaluation compared to the ISM method. In this respect, both methods can play complementary roles while analyzing the relationships between factors (Chuang et al., 2013). For this reason, ISM and DEMATEL methods were applied in the current study.

In the first phase, knowledge-sharing barriers identified in the literature review (Table 2) were examined to see whether they were relevant for academics in Turkey. The obtained barriers were presented to 13 academics who work in different disciplines at public and private universities. The interviewed experts had professional experience ranging from

Table 2. Literature review of knowledge sharing barriers in academic field.

	Knowledge sharing barriers	Author(s)									
		Hew & Hara (2007)	Jain et al. (2007)	Kim & Ju (2008)	Sohail & Daud (2009)	Wang et al. (2010)	Zawawi et al. (2011)	Yassin et al. (2013)	Yeşil & Hırlak (2013)	Santosh & Panda (2016)	Tahir et al. (2016)
O	Lack of trust among colleagues		✓	✓	✓				✓	✓	
O	Lack of leadership and managerial direction								✓		
O	Power relations (strong hierarchy)		✓		✓				✓		
O	Not intended to share knowledge within organizational goals								✓		
O	Lack of reward and incentive system		✓	✓	✓		✓	✓	✓	✓	
O	Lack of supportive corporate culture		✓					✓	✓	✓	
O	Poor physical work environment/ work areas		✓		✓				✓		
O	Lack of teamwork culture/collaboration			✓						✓	
O	Unfair evaluation for scientific researches					✓					
O	Not having academic contact with other institutions					✓					
O	Lack of management support							✓			✓
O	Corporate structure							✓			
O	Lack of activities related to knowledge sharing		✓					✓			
O	Lack of interest in the sharing of resources among the faculty									✓	
I	Lack of time	✓	✓		✓				✓	✓	✓
I	Lack of social networks				✓				✓		
I	Fear of job security								✓		
I	Poor communication and interpersonal skills		✓	✓	✓	✓				✓	
I	Age differences								✓		
I	Differences in experience levels								✓		
I	Fear of not receiving recognition from colleagues								✓		
I	Ineffective protection of individual knowledge					✓					
I	Failure to share knowledge due to fear of losing position					✓					
I	Not indicating the source of knowledge					✓					
I	Fear of free-riding because some scholars just stay idle and make no contribution					✓					
I	Reluctance to ask questions or ask for help in fear of being considered ignorant and rejection					✓					
I	Academic workloads										✓
I	Negative individualistic characteristics										✓
I	Lack of perception about value and necessity of knowledge sharing		✓	✓					✓		
I	The fear of misuse of shared knowledge		✓						✓		
I	Lack of knowledge about copyright and licensing options									✓	
T	Lack of technology (system)	✓	✓		✓		✓		✓		
T	Lack of technological system training								✓		
T	Lack of technological literacy required for knowledge sharing				✓				✓		

Note: **I:** Individual barriers, **O:** Organizational barriers, **T:** Technological barriers.

14 to 48 years and held various administrative duties (Table 3). The barriers obtained from the literature were given to the experts through the prepared questionnaire to find out whether these barriers were applicable to the academics in Turkey. Also, the impact ratings of these barriers were evaluated by the participants.

Figure 1. Research flow.

The ISM and DEMATEL methods were used in the second phase in the analysis of the knowledge sharing barriers that reached over 90% agreement, in line with the first phase results. The profile of the academics who participated in the second phase is presented in Table 4.

Application of the ISM Method

The following 6 steps are followed to apply the ISM method:

Obtaining the Structural Self-Interaction Matrix (SSIM)

For the determination of the dependencies between the identified barriers in the first phase of the study, a total of 16 academics with 4 to 48 years of professional experience having held different administrative and academic positions at various universities were asked to answer the questionnaire. They were from different disciplines such as education, law, marketing, logistics, medicine, business, management and organization, tourism, architecture, organizational behavior, and strategic management.

Generally, four symbols were used to detect the relationship between barriers. These are V, A, X, and O symbols.

- V= Factor i affects factor j but the reverse is not true
- A= Factor i does not affect factor j but the reverse is true
- X= Both the factors mutually affect one another
- O= None of the factors affect one another.

Obtaining the Initial Reachability Matrix

Once the relationship between all variables was evaluated by the experts and a general SSIM was obtained, the matrix was

Table 3. Academic participants of first phase of the study.

Participant	Academic experience (Years)	Administrative duties
1	40	Vice Dean, Head of Department
2	20	Head of Department, Dean
3	32	Dean, Head of College, Head Physician, Vice Rector, Institute Director, Head of Science Branch
4	38	Head of Science Branch, Head of Department, Vice Dean, Dean, Vice Rector, Senatorship
5	14	Institute Director
6	22	Vice Head of Department, Head of Science Branch, Vice Dean, Dean
7	29	Institute Director, Head of Department
8	26	-
9	48	Head of College, Dean, Vice Rector, Rector
10	35	Head of Science Branch, Head of Department, Dean
11	20	-
12	33	Head of Department, Dean, Vice Rector
13	17	Institute Director

Table 4. Academic participants of second phase of the study.

Participant	Academic experience (Years)	Administrative duties	Research area
1	32	-	Turkish Education, Turkish Literature
2	5	Commission Membership	Law
3	4	-	Marketing, Logistics
4	31	Vice Dean, Vice Rector, Head Physician, Institute Director	Medical Pharmacology
5	8	-	Business
6	13	Head of Department, Vice Dean, Head of Science Branch	Educational Science, Organizational Behavior
7	28	Vice Dean, Dean, Vice Rector, Rector	Engineering
8	32	Vice Dean, Head of Department, Member of Board of Directors	Strategy and Management
9	16	Head of Department	Logistics, Supply Chain Management
10	26	Head of Department, Head of College, Senator, Dean	Tourism, Marketing
11	21	Vice Dean, Head of Department	Architecture, Planning
12	14	Head of Department	Behavioral Sciences
13	14	Head of Department, Vice Head of Department	Strategic Management
14	10	Member of Board of Directors, Erasmus Coordinator	Management and Organization, Organizational Behavior
15	8	Vice Dean	Logistics
16	38	Head of Department, Dean, Rector	Data and Konowledge Management, Quality Management, Competition

Instutions of academics: Afyon Kocatepe University, Akdeniz Karpaz University, Akdeniz University, Anadolu University, Bahçeşehir University, Beykent University, Beykoz University, Cambrige University, Chalmers University of Technology, Dokuz Eylül University, Erciyes University, Eskişehir Osmangazi University, Haliç University, Hong Kong Polytechnic University, Istanbul Arel University, İstanbul Bilgi University, İstanbul Kültür University, İstanbul Technical University, İstanbul University, Manisa Celal Bayar University, Marmara University, Muğla Sıtkı Koçman University, Ondokuz Mayıs University, Sakarya University, University of Namur, University of Southampton, Yaşar University, Yeditepe University.

converted into a numerical matrix. During this conversion, the following rules were followed according to each situation;

- If (i, j) in SSIM equals V, then (i, j) reachability matrix equals 1 and (j,i) equals 0.
- If (i, j) in SSIM equals A, then (i, j) in reachability matrix equals 0 and (j,i) equals 1.
- If (i, j) in SSIM equals X, then, (i, j) in reachability matrix equals 1 and (j,i) equals 1.
- If entry (i, j) in SSIM equals 0, then, (i, j) in reachability matrix equals 0 and (j,i) equals 0.

Obtaining the Final Reachability Matrix

After the initial reachability matrix was obtained, Driving Power and Dependence Power values were calculated.

Determination of the Level and Priorities of the Variables

Then the reachability and antecedent sets were calculated by using the final reachability matrix for each barrier. The barrier, which has the same reachability and intersection sets, was found and it was determined as the barrier at the first level. If more than one barrier fit this description, all were taken to the first level. Then the codes of the barriers taken to the first level were deleted from the table, and the barrier with the same reachability and intersection sets was searched. The process continued in this way and all levels of barriers were identified.

Drawing the ISM Model

After the level determination phase, the ISM model was developed as level 1 on top.

MICMAC Analysis

According to the obtained driving power and dependence power values, MICMAC analysis was performed by placing the barriers on the graph (Mandal & Deshmukh, 1994), and the barriers were divided into 4 categories:

- **Autonomous barriers:** Low driving, low dependence power
- **Dependent barriers:** Low driving, high dependence power
- **Linkage barriers:** High driving, high dependence power
- **Independent barriers:** High driving, low dependence power

Application of the DEMATEL Method

The 6 steps of the DEMATEL method are as follows:

- **Designing the evaluation scale and determining the causal relationship:** By means of a questionnaire, all the criteria were compared with one another and the causal relationship between them and the grade of the relationships were determined.
- **Obtaining a direct relation matrix:** Response matrices were obtained by the responses of each participant and then the direct relation matrix was calculated by taking the arithmetic mean of the answers given by the participants.
- **Calculation of normalized direct relation matrix:** Row totals and column totals of the direct relation matrix were calculated. Then, by selecting the highest sum, each cell in the direct relation matrix was divided into this sum and a normalized matrix was obtained.
- **Calculation of the total relation matrix (T):** After the normalized direct relation matrix was obtained, the total correlation matrix was calculated.
- The values in each row and each column were summed up to obtain the values of Di and Rj.
- Obtaining the cause-effect diagram using D and R values.

A causality diagram (D + R, D - R) was obtained by mapping the data sets. The horizontal axis (D + R) indicates the degree of prominence and the vertical axis (D - R) indicates the degree of relation. The vertical axis is divided into cause and effect groups. The factors that are left in the part where the axis is positive are the cause, and those in the part where the axis is negative are the effect variables.

Results

First Phase Results of the Study

The findings obtained by taking the opinions of the experts in the first phase of the research are presented in Table 5. Four knowledge-sharing barriers were determined by the experts to reach full agreement. “Lack of teamwork culture and cooperation”, one of the organizational knowledge sharing barriers upon which there was a full agreement, is considered highly powerful by the vast majority of the experts. Six of the barriers mentioned to be powerful by 12 experts are individual and five of them are organizational barriers. Two of the barriers with 84.6% compromise rate are organizational and three are individual barriers. Only a 46.2% agreement rate was reached on whether the “lack of technology” barrier was powerful. While the “lack of technological information required for knowledge sharing” barrier is stated as powerful by 8 experts, it is stated as weak by 5 experts.

Second Phase Results of the Study

ISM Results

The results of the first stage of the ISM application are given in Table 6. Benchmarking symbols are based on the answers given by the participants with the highest consensus.

Although there are mostly one-way or two-way relationships between the barriers, there is no relation between some barriers.

Table 5. First phase findings of the study.

Knowledge sharing barriers	..... in knowledge sharing between academics		Very weak	Weak	Moderately powerful	Powerful	Very powerful
	Powerful	Not powerful					
Lack of time	8 (61.5%)	5 (38.5%)	-	2	1	4	1
Lack of technology (system)	6 (46.2%)	7 (53.8%)	-	2	1	3	-
Lack of trust among colleagues	12 (92.3%)	1 (7.7%)	1	1	3	3	4
Lack of leadership and managerial direction	12 (92.3%)	1 (7.7%)	1	1	1	7	2
Low awareness related to value of the knowledge	12 (92.3%)	1 (7.7%)	-	-	6	3	3
Lack of social networks	11 (84.6%)	2 (15.4%)	-	1	2	6	2
Power relations (strong hierarchy)	13 (100%)	-	-	3	4	5	1
Not intended to share knowledge within organizational goals	13 (100%)	-	-	2	3	5	3
Lack of technological system training	9 (69.2%)	4 (30.8%)	-	3	3	3	-
Fear of job security	7 (53.8%)	6 (46.2%)	2	2	2	-	1
Poor communication and interpersonal skills	12 (92.3%)	1 (7.7%)	-	2	5	4	1
Age differences	7 (53.8%)	6 (46.2%)	1	2	2	2	-
Differences in experience levels	9 (69.2%)	4 (30.8%)	1	2	2	4	-
Fear of not receiving recognition from colleagues	9 (69.2%)	4 (30.8%)	-	1	6	2	-
Lack of reward and incentive system	10 (76.9%)	3 (23.1%)	1	1	1	5	2
Lack of supportive corporate culture	12 (92.3%)	1 (7.7%)	-	1	3	4	4
Poor physical work environment/ work areas	10 (76.9%)	3 (23.1%)	-	3	4	1	2
Lack of technological literacy required for knowledge sharing	8 (61.5%)	5 (38.5%)	-	2	3	2	1
Lack of teamwork culture/collaboration	13 (100%)	-	1	1	-	6	5
Ineffective protection of individual knowledge	9 (69.2%)	4 (30.8%)	-	1	3	4	1
Abstentions related to asking for help	12 (92.3%)	1 (7.7%)	1	5	3	3	-
Failure to share knowledge due to fear of losing position	11 (84.6%)	2 (15.4%)	-	2	4	3	2
Unfair evaluation for scientific research	7 (53.8%)	6 (46.2%)	1	2	2	1	1
Not indicating the source of knowledge	9 (69.2%)	4 (30.8%)	1	2	2	2	2
Not having academic contact with other institutions	12 (92.3%)	1 (7.7%)	1	-	2	5	4
Fear of free-riding because some scholars just stay idle and make no contribution	9 (69.2%)	4 (30.8%)	-	-	2	5	2
Reluctance to ask others in fear of being considered ignorant	12 (92.3%)	1 (7.7%)	-	5	3	2	2
Academic workloads	11 (84.6%)	2 (15.4%)	3	-	2	3	3
Negative individualistic characteristics	12 (92.3%)	1 (7.7%)	1	2	3	2	4
Lack of management support	11 (84.6%)	2 (15.4%)	1	-	6	2	2
Lack of perception about necessity of knowledge sharing	12 (92.3%)	1 (7.7%)	-	4	2	4	2
Corporate structure	12 (92.3%)	1 (7.7%)	1	2	4	4	1
Lack of related activities to knowledge sharing	13 (100%)	-	1	3	4	4	1
The fear of misuse of shared knowledge	10 (76.9%)	3 (23.1%)	-	4	1	4	1
Lack of interest in sharing resources among the faculty	11 (84.6%)	2 (15.4%)	1	4	3	2	1
Lack of knowledge about copyright and licensing options	8 (61.5%)	5 (38.5%)	-	2	5	1	-

Table 6. Structural self-interaction matrix (SSIM).

		2	3	4	5	6	7	8	9	10	11	12	13	14	15
K1	Lack of trust among colleagues	A	X	A	X	X	A	X	V	V	A	X	A	X	O
K2	Lack of leadership and managerial direction		V	A	X	X	X	X	V	V	X	X	X	X	V
K3	Low awareness related to value of the knowledge			A	X	X	A	A	X	O	A	X	A	X	O
K4	Power relations (strong hierarchy)				V	O	V	V	V	V	O	V	X	V	V
K5	Not intended to share knowledge within organizational goals					X	A	X	V	V	O	X	A	X	V
K6	Poor communication and interpersonal skills						X	X	V	X	A	X	A	X	X
K7	Lack of supportive corporate culture							X	V	V	O	X	X	V	V
K8	Lack of teamwork culture/collaboration								V	V	A	X	X	X	X
K9	Abstentions related to asking for help									X	A	A	A	X	O
K10	Reluctance to ask others in fear of being considered ignorant										A	O	A	A	O
K11	Negative individualistic characteristics											V	O	V	V
K12	Lack of perception about necessity of knowledge sharing												A	X	V
K13	Corporate structure													V	V
K14	Lack of activities related to knowledge sharing														X
K15	Not having academic contact with other institutions														

The barriers that have no relationship with one another are:

- "Lack of trust" and "Not having academic contact with other institutions"
- "Low awareness related to the value of the knowledge" and "Reluctance to ask others for fear of being considered ignorant"
- "Low awareness related to value of the knowledge" and "Not having academic contact with other institutions"
- "Power relations" and "Poor communication and interpersonal skills"
- "Power relations" and "Negative individualistic characteristics"
- "Not intended to share knowledge within organizational goals" and "Negative individualistic characteristics"
- "Lack of supportive corporate culture" and "Negative individualistic characteristics"
- "Abstentions related to asking for help" and "Not having academic contact with other institutions"
- "Reluctance to ask others for fear of being considered ignorant" and "Lack of perception about the necessity of knowledge sharing"
- "Reluctance to ask others for fear of being considered ignorant" and "Not having academic contact with other institutions"
- "Negative individualistic characteristics" and "Corporate structure"

The Structural Self-Interaction Matrix, which consists of symbols according to the rules mentioned in the second step of the ISM application in Method, was transformed into the Initial Reachability Matrix. Then in the third step the Final Reachability Matrix was obtained by calculating the Driver and Dependence Power values. These two matrices were combined and their results are presented in Table 7. The driver and dependence power values obtained in this step were then used in the MICMAC analysis.

In the fourth step, the reachability and antecedent sets for each barrier were determined by using the values in the Initial Reachability Matrix. Then, the barriers numbered 3, 9, 10, 15 with the same intersection and reachability sets were positioned at the 1st level. The numbers of the positioned barriers were removed from the intersection and reachability sets and the analyses continued. These analyses lasted 5 rounds and all the barriers were collected at 5 levels. In Table 8, reachability, antecedent, intersection values of the barriers and their levels are shown.

Once the levels for all barriers were determined, step five began and the ISM Models in Figure 2 were obtained. Power relations were placed at the bottom of the model, which is the fifth level barrier. Upper and horizontal relationships of the barriers were visualized through the Structural Self-Interaction Matrix (SSIM).

Table 7. Initial and final reachability matrix.

	K1	K2	K3	K4	K5	K6	K7	K8	K9	K10	K11	K12	K13	K14	K15	Driver
K1	1	0	1	0	1	1	0	1	1	1	0	1	0	1	0	9
K2	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	14
K3	1	0	1	0	1	1	0	0	1	0	0	1	0	1	0	7
K4	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	13
K5	1	1	1	0	1	1	0	1	1	1	0	1	0	1	1	11
K6	1	1	1	0	1	1	1	1	1	1	0	1	0	1	1	12
K7	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	13
K8	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	13
K9	0	0	1	0	0	0	0	0	1	1	0	0	0	1	0	4
K10	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	3
K11	1	1	1	0	0	1	0	1	1	1	1	1	0	1	1	11
K12	1	1	1	0	1	1	1	1	1	0	0	1	0	1	1	11
K13	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	14
K14	1	1	1	0	1	1	0	1	1	1	0	1	0	1	1	11
K15	0	0	0	0	0	1	0	1	0	0	0	0	0	1	1	4
Dependence	12	10	13	2	11	13	7	12	14	12	2	12	5	14	11	

As Figure 2 shows, the power relations barrier (high hierarchy) is at the bottom of the ISM model. This suggests that power relations in the academic community affect all other knowledge-sharing barriers. Moreover, the two-way relationship between power relations and organizational structure barriers indicates that these barriers are influenced by each other. It was also determined that the organizational structure at the same level had a two-way interaction between

Table 8. Use of reachability matrix in level setting.

	Reachability	Antecedent	Intersection	Level
1	1,3,5,6,8,9,10,12,14	1,2,3,4,5,6,7,8,11,12,13,14	1,3,5,6,8,12,14	2
2	1,2,3,5,6,7,8,9,10,11,12,13,14,15	2,4,5,6,7,8,11,12,13,14	2,5,6,7,8,11,12,13,14	3
3	1,3,5,6,7,9,12,14	1,2,3,4,5,6,7,8,9,11,12,13,14	1,3,5,6,7,9,12,14	1
4	1,2,3,4,5,7,8,9,10,12,13,14,15	4,13	4,13	5
5	1,2,3,5,6,8,9,10,12,14,15	1,2,3,4,5,6,7,8,12,13,14	1,2,3,5,6,8,12,14	2
6	1,2,3,5,6,7,8,9,10,12,14,15	1,2,3,5,6,7,8,10,11,12,13,14,15	1,2,3,5,6,7,8,10,12,14,15	2
7	1,2,3,5,6,7,8,9,10,12,13,14,15	2,4,6,7,8,12,13	2,6,7,8,12,13	4
8	1,2,3,5,6,7,8,9,10,12,13,14,15	1,2,4,5,6,7,8,11,12,13,14,15	1,2,5,6,7,8,12,13,14,15	2
9	3,9,10,14	1,2,3,4,5,6,7,8,9,10,11,12,13,14	3,9,10,14	1
10	6,9,10	1,2,4,5,6,7,8,9,10,11,13,14	6,9,10	1
11	1,2,3,6,8,9,10,11,12,14,15	2,11	2,11	4
12	1,2,3,5,6,7,8,9,12,14,15	1,2,3,4,5,6,7,8,11,12,13,14	1,2,3,5,6,7,8,12,14	2
13	1,2,3,4,5,6,7,8,9,10,12,13,14,15	2,4,7,8,13	2,4,7,8,13	4
14	1,2,3,5,6,8,9,10,12,14,15	1,2,3,4,5,6,7,8,9,11,12,13,14,15	1,2,3,5,6,8,9,14,15	3
15	6,8,14,15	2,4,5,6,7,8,11,12,13,14,15	6,8,14,15	1

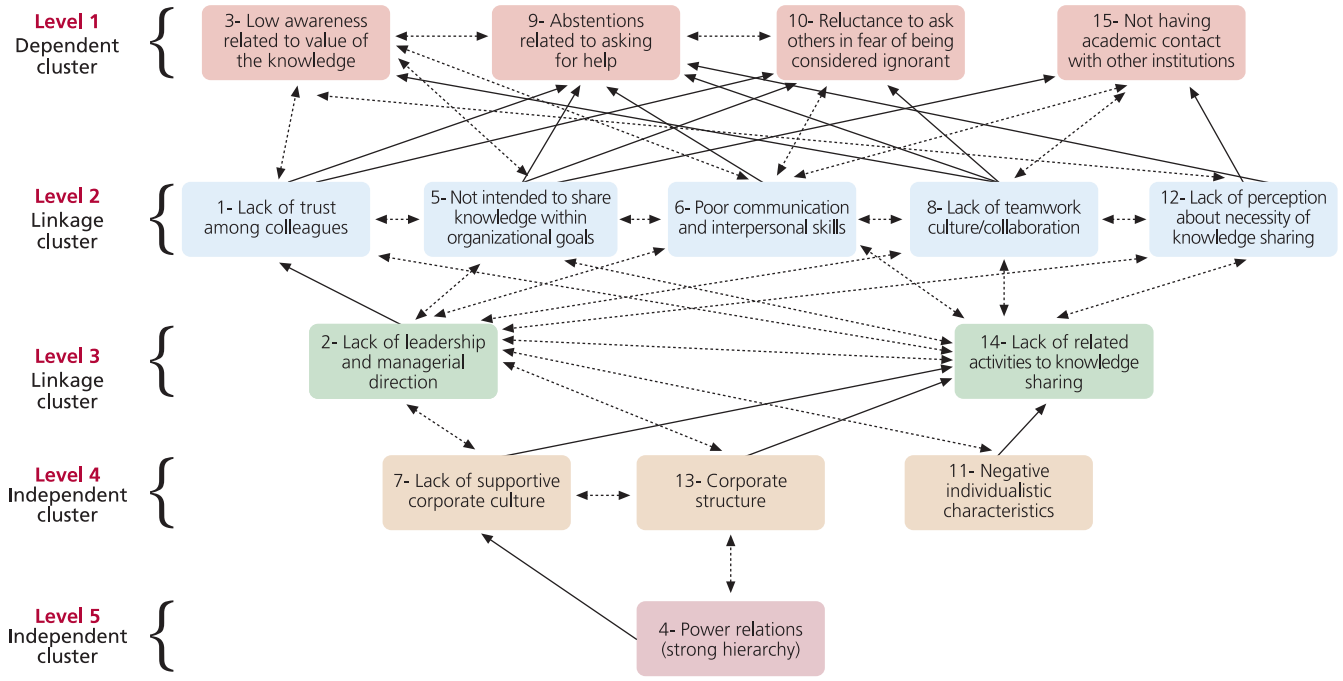

Figure 2. ISM model.

the lack of supportive corporate culture. The lack of activities related to knowledge sharing from third-level barriers, the fact that the three barriers from the fourth level are influential in one way, and the fact that the barriers have a completely two-way interaction from the barriers at the second level indicate the importance of overcoming knowledge sharing barriers. It was also observed that lack of teamwork culture/collaboration barrier from the second level barriers had a two-way interaction with not having academic contact with other institutions barrier, but one-way interaction with all barriers from the first level barriers.

Besides, it was determined that there was a two-way interaction between the barriers related to asking for help from the first level barriers and reluctance to ask others for fear of being considered ignorant. Therefore, it can be said that the individual reservations and fears that academics feel about sharing knowledge are among the important factors that prevent academic knowledge sharing. Apart from the relationships mentioned here, there are also many one-way and two-way relationships shown in Figure 2. However, only some significant barriers are discussed in this section and then the MICMAC analyses are presented.

In Figure 3, the MICMAC analysis is visualized which is categorized according to the dependent and driver power values calculated in Table 7. As can be seen from the figure, none of the barriers are located in the cluster of autonomous barriers in which weak driver and weak dependent forces are grouped. In the dependent cluster of weak-driver and high-dependence forces, barriers of "low awareness related to the value of the knowledge", "abstentions related to asking for help", "reluctance to ask others for fear of being considered ignorant", and "not having academic contact with other institutions" are included. All of these barriers are at the top (1) level in the ISM model and they are highly dependent on other barriers. At the intersection of the high driver and high dependence power, there are knowledge-sharing barriers which are at the second and the third level in the ISM model. Finally, the barriers of "lack of supportive corporate culture", "corporate structure", "negative individualistic characteristics," and "power relations" with weak dependence high driver power located at the bottom of the ISM model, are included in the linkage cluster.

DEMATEL Results

The responses of all the participants were transferred into a direct relationship matrix. Then, the arithmetic mean of these responses and the direct relation matrix presented in Table 9 were obtained.

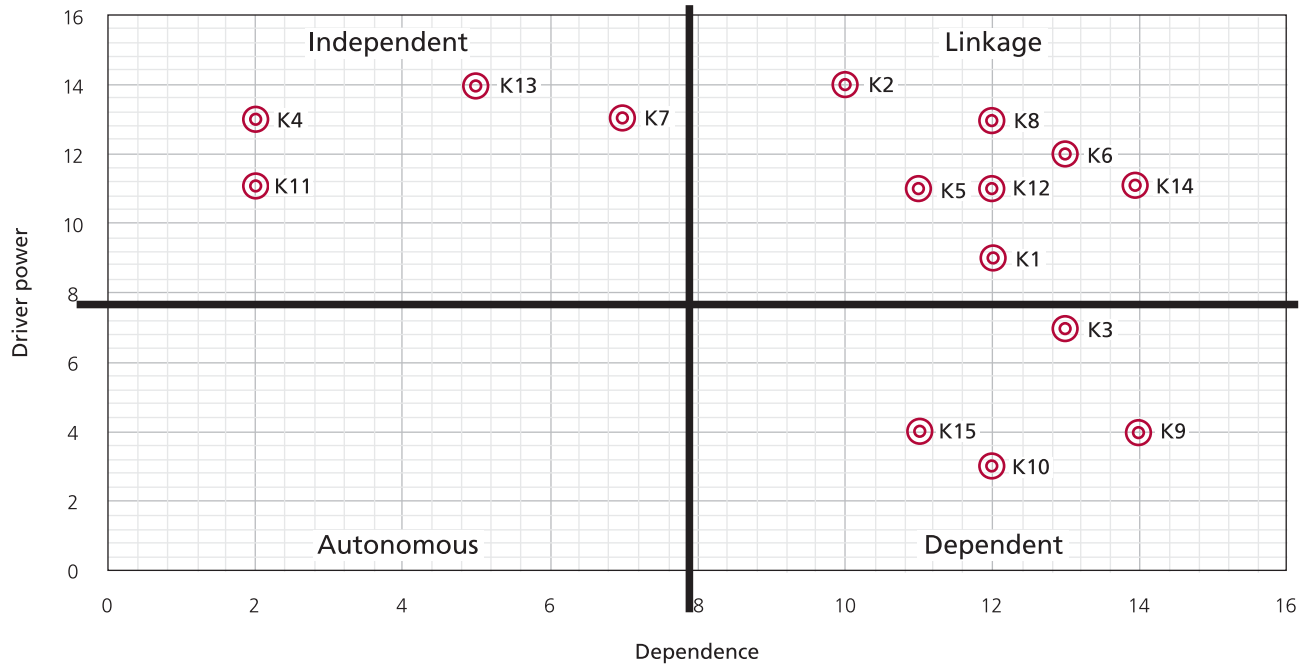

Figure 3. MICMAC analysis.

In the next step, the highest value in the row and column totals was found. Then, the cells in Table 9 were normalized to obtain the normalized direct relationship matrix in Table 10.

The values in the normalized relationship matrix were processed, and the total relationship matrix in Table 11 was obtained.

Table 9. Direct relation matrix.

	K1	K2	K3	K4	K5	K6	K7	K8	K9	K10	K11	K12	K13	K14	K15
K1	0.00	4.00	3.00	0.00	3.60	3.00	4.00	4.33	4.00	3.50	3.00	2.00	0.00	3.25	3.50
K2	3.70	0.00	3.33	0.00	3.20	2.50	4.00	4.20	3.00	2.57	0.00	3.00	0.00	3.57	2.71
K3	3.75	0.00	0.00	0.00	3.00	0.00	0.00	3.50	3.40	3.00	4.00	3.75	0.00	3.25	3.00
K4	4.00	3.33	3.43	0.00	3.44	3.80	4.00	3.78	4.00	3.62	3.00	3.63	4.00	3.56	3.43
K5	3.00	0.00	3.83	2.50	0.00	3.00	3.00	3.33	3.33	3.00	0.00	4.50	4.00	4.00	3.14
K6	4.25	3.33	3.20	3.50	2.67	0.00	2.50	3.00	3.56	3.33	3.00	3.25	0.00	4.00	3.80
K7	4.11	4.00	3.45	3.50	3.88	3.50	0.00	3.83	3.75	3.58	3.75	3.50	3.00	4.00	3.30
K8	4.50	4.00	3.13	3.50	3.80	3.33	0.00	0.00	3.67	3.64	4.00	3.83	0.00	3.67	3.40
K9	0.00	0.00	3.00	5.00	3.00	2.00	0.00	4.00	0.00	4.50	3.00	2.00	3.00	3.00	2.50
K10	4.00	0.00	3.50	5.00	2.00	0.00	0.00	0.00	4.00	0.00	3.00	0.00	0.00	4.00	0.00
K11	3.90	3.17	3.40	3.50	2.80	3.71	3.00	3.50	3.75	3.29	0.00	3.22	3.60	3.63	3.88
K12	2.50	4.00	4.50	3.00	3.67	4.00	3.00	3.00	3.86	3.20	0.00	0.00	0.00	4.50	3.67
K13	4.13	4.50	3.14	4.25	3.70	3.57	4.00	3.33	3.20	3.09	2.50	4.00	0.00	3.40	3.10
K14	3.00	0.00	4.00	0.00	3.67	3.00	3.00	3.00	2.67	3.17	3.00	3.33	0.00	0.00	0.00
K15	2.00	0.00	3.00	0.00	0.00	2.00	0.00	0.00	4.00	3.00	0.00	0.00	0.00	3.67	0.00

Table 10. Normalized direct relation matrix.

	K1	K2	K3	K4	K5	K6	K7	K8	K9	K10	K11	K12	K13	K14	K15
K1	0.00	0.08	0.06	0.00	0.07	0.06	0.08	0.08	0.08	0.07	0.06	0.04	0.00	0.06	0.07
K2	0.07	0.00	0.06	0.00	0.06	0.05	0.08	0.08	0.06	0.05	0.00	0.06	0.00	0.07	0.05
K3	0.07	0.00	0.00	0.00	0.06	0.00	0.00	0.07	0.07	0.06	0.08	0.07	0.00	0.06	0.06
K4	0.08	0.06	0.07	0.00	0.07	0.07	0.08	0.07	0.08	0.07	0.06	0.07	0.08	0.07	0.07
K5	0.06	0.00	0.07	0.05	0.00	0.06	0.06	0.06	0.06	0.06	0.00	0.09	0.08	0.08	0.06
K6	0.08	0.06	0.06	0.07	0.05	0.00	0.05	0.06	0.07	0.06	0.06	0.06	0.00	0.08	0.07
K7	0.08	0.08	0.07	0.07	0.08	0.07	0.00	0.07	0.07	0.07	0.07	0.07	0.06	0.08	0.06
K8	0.09	0.08	0.06	0.07	0.07	0.06	0.00	0.00	0.07	0.07	0.08	0.07	0.00	0.07	0.07
K9	0.00	0.00	0.06	0.10	0.06	0.04	0.00	0.08	0.00	0.09	0.06	0.04	0.06	0.06	0.05
K10	0.08	0.00	0.07	0.10	0.04	0.00	0.00	0.00	0.08	0.00	0.06	0.00	0.00	0.08	0.00
K11	0.08	0.06	0.07	0.07	0.05	0.07	0.06	0.07	0.07	0.06	0.00	0.06	0.07	0.07	0.08
K12	0.05	0.08	0.09	0.06	0.07	0.08	0.06	0.06	0.07	0.06	0.00	0.00	0.00	0.09	0.07
K13	0.08	0.09	0.06	0.08	0.07	0.07	0.08	0.06	0.06	0.06	0.05	0.08	0.00	0.07	0.06
K14	0.06	0.00	0.08	0.00	0.07	0.06	0.06	0.06	0.05	0.06	0.06	0.06	0.00	0.00	0.00
K15	0.04	0.00	0.06	0.00	0.00	0.04	0.00	0.00	0.08	0.06	0.00	0.00	0.00	0.07	0.00

Table 12 was obtained by using the line totals (D) and column totals (R) values obtained in Table 11, then calculating the prominence (D + R) and effect (D-R) values of the obstacles. The barriers in the section where the D-R value is positive show the cause variables and the ones in the negative part show the effect variables.

The causality diagram shown in Figure 4 was formed based on the cause and effect values obtained.

Table 11. Total relation matrix.

	K1	K2	K3	K4	K5	K6	K7	K8	K9	K10	K11	K12	K13	K14	K15	D
K1	0.19	0.18	0.25	0.14	0.24	0.20	0.19	0.24	0.28	0.26	0.20	0.19	0.07	0.27	0.22	3.12
K2	0.23	0.10	0.23	0.12	0.20	0.17	0.17	0.22	0.23	0.21	0.12	0.19	0.06	0.25	0.18	2.68
K3	0.20	0.08	0.15	0.11	0.18	0.11	0.09	0.19	0.22	0.20	0.18	0.18	0.05	0.21	0.17	2.31
K4	0.31	0.20	0.32	0.18	0.28	0.25	0.23	0.28	0.33	0.31	0.23	0.27	0.17	0.33	0.27	3.96
K5	0.24	0.12	0.26	0.19	0.17	0.21	0.18	0.23	0.26	0.25	0.14	0.24	0.15	0.28	0.21	3.14
K6	0.27	0.17	0.26	0.21	0.22	0.15	0.17	0.23	0.28	0.25	0.20	0.22	0.08	0.29	0.23	3.24
K7	0.31	0.22	0.32	0.24	0.29	0.25	0.15	0.28	0.32	0.31	0.24	0.27	0.15	0.34	0.26	3.95
K8	0.28	0.19	0.27	0.21	0.25	0.21	0.13	0.18	0.28	0.27	0.22	0.23	0.08	0.29	0.23	3.31
K9	0.17	0.10	0.23	0.22	0.21	0.17	0.11	0.22	0.18	0.25	0.19	0.18	0.13	0.24	0.19	2.80
K10	0.20	0.07	0.20	0.18	0.16	0.10	0.08	0.12	0.21	0.13	0.16	0.11	0.06	0.21	0.11	2.09
K11	0.30	0.19	0.30	0.23	0.25	0.24	0.20	0.27	0.31	0.28	0.17	0.24	0.15	0.31	0.26	3.70
K12	0.24	0.19	0.29	0.19	0.24	0.22	0.18	0.23	0.27	0.25	0.15	0.16	0.07	0.30	0.22	3.21
K13	0.31	0.23	0.30	0.25	0.28	0.25	0.23	0.27	0.31	0.29	0.22	0.27	0.09	0.32	0.25	3.86
K14	0.21	0.09	0.23	0.12	0.21	0.18	0.15	0.20	0.21	0.21	0.17	0.19	0.06	0.17	0.13	2.52
K15	0.11	0.04	0.14	0.06	0.07	0.09	0.04	0.07	0.16	0.14	0.06	0.06	0.03	0.15	0.06	1.27
R	3.56	2.17	3.74	2.64	3.25	2.82	2.30	3.24	3.84	3.60	2.65	3.00	1.38	3.96	2.99	

Table 12. Cause-effect values.

	Barriers	D	R	D+R	D-R	
K1	Lack of trust among colleagues	3.12	3.56	6.68	-0.44	EFFECT
K2	Lack of leadership and managerial direction	2.68	2.17	4.85	0.51	CAUSE
K3	Low awareness related to value of the knowledge	2.31	3.74	6.05	-1.43	EFFECT
K4	Power relations (strong hierarchy)	3.96	2.64	6.60	1.32	CAUSE
K5	Not intended to share knowledge within organizational goals	3.14	3.25	6.39	-0.12	EFFECT
K6	Poor communication and interpersonal skills	3.24	2.82	6.06	0.41	CAUSE
K7	Lack of supportive corporate culture	3.95	2.30	6.25	1.65	CAUSE
K8	Lack of teamwork culture/collaboration	3.31	3.24	6.56	0.07	CAUSE
K9	Abstentions related to asking for help	2.80	3.84	6.64	-1.04	EFFECT
K10	Reluctance to ask others in fear of being considered ignorant	2.09	3.60	5.69	-1.51	EFFECT
K11	Negative individualistic characteristics	3.70	2.65	6.36	1.05	CAUSE
K12	Lack of perception about necessity of knowledge sharing	3.21	3.00	6.21	0.21	CAUSE
K13	Corporate structure	3.86	1.38	5.24	2.49	CAUSE
K14	Lack of activities related to knowledge sharing	2.52	3.96	6.48	-1.44	EFFECT
K15	Not having academic contact with other institutions	1.27	2.99	4.26	-1.72	EFFECT

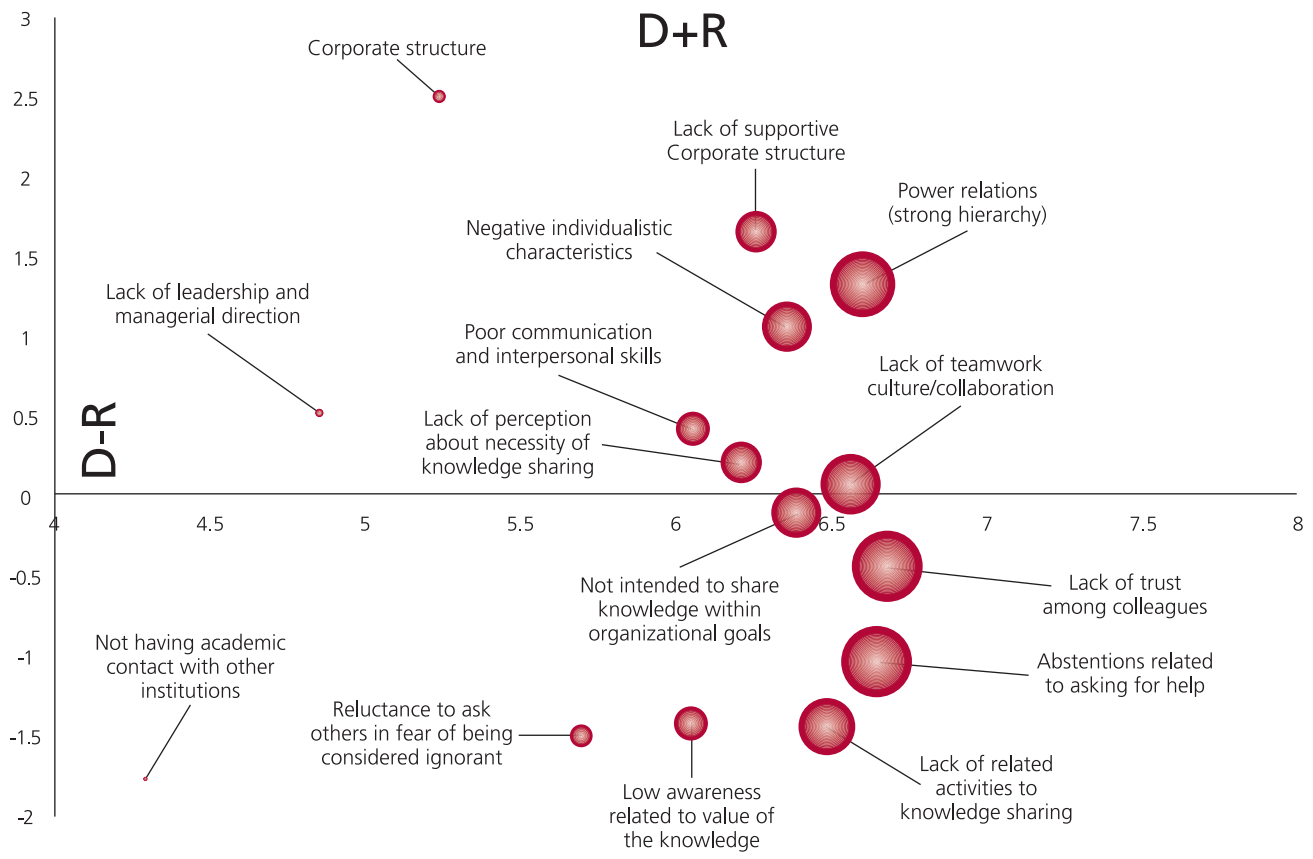

Figure 4. DEMATEL causal effect diagram.

The relationships between the barriers and the structure are clearly visualized in Figure 4. The barriers of K2, K4, K6, K7, K8, K11, K12, K13 are located in the cause group and K1, K3, K5, K9, K10, K14, K15 barriers are located in the group of effect. Based on these findings, it can be said that overcoming the knowledge sharing barriers in the cause group will require a more challenging process compared to the affected group.

The corporate structure (K13) is the most influential factor among knowledge sharing barriers, while the lack of trust among colleagues (K1), abstentions about asking for help (K9), power relations (K4), lack of teamwork culture and coordination (K8) are the most important knowledge sharing barriers, respectively.

Discussion

In the first phase of the study, we found that knowledge sharing barriers of academics in Turkey result from organizational and individual factors. While our findings differ from the study of Zawawi et al. (2011) where the impact of technological barriers on knowledge sharing is emphasized, our findings are consistent with the findings of the Yeşil and Hırlak's (2013) study conducted in Turkey. Also, Jain et al. (2007) conclude that the impact of lack of technology on knowledge sharing is relatively weak.

According to the ISM model in which the relationship and the hierarchy between the barriers are shown in the second phase of the study, the barrier which has the highest driver power is the "power relations", which is an organizational barrier. While there is a mutual relationship between "power relations" and "corporate structure", it is also observed that "power relations" affect the "supportive corporate culture". Additionally, the significance of the "corporate structure" is supported by the DEMATEL findings. Our results from these two models support the findings of the studies in the literature (e.g. Al-Kurdi et al., 2018; Jain et al., 2007; Santosh & Panda, 2016; Sohail & Daud, 2009; Tahir et al., 2016, Tseng, 2017; Wang & Noe, 2010) indicating that organizational structure, organizational culture, and management support are important factors in knowledge sharing.

Academic and Practical Contributions

The results obtained from the ISM hierarchy model and cause-and-effect diagram are useful not only for the academic field, but also for policy-makers. Knowledge-sharing barriers are generally categorized in the literature as "organizational", "individual," and "technological". Our findings reveal that the most influential academic knowledge sharing barriers in Turkey arise from the organizational aspect, such as "corporate structure" and "power relations". Since identifying the major barriers to the knowledge sharing is a complicated and time-consuming process for decision-makers in the academic field, the findings of this study provide a framework for policymakers who are in charge of taking regulatory actions.

Overcoming the knowledge sharing barriers in the cause group (lack of leadership and managerial direction, power relations, poor communication, and interpersonal skills, lack of supportive corporate culture, lack of teamwork culture, negative individualistic characteristics, lack of perception about the necessity of knowledge sharing, corporate structure) is more challenging compared to the affected group, and the strongest one among these cause barriers is the corporate structure. Moreover, the main factor underlying all knowledge-sharing barriers is the power relations (strong hierarchy). It would be helpful to focus on the corporate structure and power relations in the universities and make some regulations to overcome the effects of the rest of the knowledge sharing barriers.

Conclusions and Future Research Directions

Universities are the pioneers of generating scientific knowledge. From the perspective of knowledge management, universities are expected to have an understanding based on sharing their scientific knowledge with their own units or with other universities. However, knowledge sharing among academics is not at the expected level due to some significant factors. In the previous studies, barriers to knowledge sharing have been investigated and some major factors have been identified but these have only been categorized and considered to be independent of one another. However, the existence of multidirectional and sequential relationships between the barriers make it necessary to examine the relations between the barriers by means of methods that allow exploring the systematic and hierarchical structures. Thus, the main purpose of this study is to determine the knowledge sharing barriers of the academics in Turkey and to demonstrate the relationships between them by using the ISM and DEMATEL methods. For this reason, in the first phase of the study, knowledge-sharing barriers obtained from the literature were presented to some experts from various disciplines for a review.

According to the first phase findings, all the barriers that are fully agreed upon by the experts are organizational. Nine of the barriers identified for the second phase of the study with over 90 percent consensus are organizational and six of them are individual. Notably, there are no technological bar-

riers that have high consensus rates. It can be inferred from the ISM model that the majority of the barriers at the fourth and fifth levels in the independent cluster are organizational barriers and that the strategies to be developed by taking into account these barriers with high driver power will accelerate the process of overcoming the knowledge sharing barriers in the academic field. Knowledge sharing barriers, most of which are comprised of individual barriers, were found to have weak driver power. Therefore, developing strategies by focusing on organizational barriers that have high driver power has great importance to eliminate the barriers of individual knowledge sharing in the academia. Considering the findings obtained by applying the DEMATEL method, the most important knowledge sharing barrier is the lack of trust among colleagues which is an organizational barrier, while the second most important knowledge sharing barrier is abstentions about asking for help, which is an individual barrier. While the knowledge sharing barrier with the highest impact is the corporate structure, the second is the lack of a supportive corporate culture.

This study has some limitations. As a major limitation, a small number of academics from a specific geographical area in Turkey participated in the research. Therefore, the study findings can be thought of as narrow-scoped, allowing limited generalization. Accordingly, in future studies, the sample of the study can be expanded by the inclusion of academics from various regions. Nevertheless, overcoming the identified barriers may help increase innovativeness and entrepreneurship at the individual, organizational and national levels. Further, universities may develop strategic roadmaps by considering these barriers and gathering the opinions of policymakers to overcome the obstacles preventing scientific knowledge sharing.

Yazar Katkıları / Author Contributions: EBK: Fikir, tasarım, bulguların yorumlanması, kaynak taraması, makalenin yazılması; BK: Eleştirel inceleme; AA: Tasarım, veri analizi, bulguların yorumlanması, makalenin yazılması; İSA: Tasarım, bulguların yorumlanması, kaynak taraması, makalenin yazılması; ÖYS: Fikir, tasarım, danışmanlık/denetleme, veri toplanması, eleştirel inceleme. / *EBK: Project idea, conceiving and designing research, interpreting the results, literature search, writing the manuscript; BK: Critical reading and final check of the manuscript; AA: Conceiving and designing the study, data analysis, interpreting the results, writing the manuscript; İSA: Conceiving and designing research, interpreting the results, literature search, writing the manuscript; ÖYS: Project idea, conceiving and designing research, study monitoring, data collection, critical reading and final check of the manuscript.*

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