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Review and Identification of Effective Factors on Knowledge Sharing in Virtual Organizations (Case Study: Irancell Company)

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Abstract: This research aims to investigate influential factors which affect knowledge sharing in virtual organizations. The case study used for the purpose of this research is one of the largest telecommunication organizations of Iran. The data gathered in a 2 month period, between June 2017 to August 2017. The studied sample includes 170 staff chosen from Irancell's personnel. In order to analyze our findings, we have employed Factor analysis, Cronbach's alpha, Kolmogorov-Smirnov one-tailed t-test and Friedman Data analysis on collected data. Our analysis has shown that structural, technological, human and cultural factors play the most significant roles on knowledge sharing in virtual organizations. Also, priority analysis has highlighted that structural factors account for the most prominent variable. The findings show that all four proposed hypotheses have been confirmed. Between four factors which have been analyzed, the structure was rated in the first place. The results also indicate that organizational culture, technology and human factors are ranked in second to fourth positions respectively. It can be inferred that managers and authorities need to implement knowledge sharing practices in virtual organisations all four identified factors should be taken into consideration. This study is one of the first studies which specifically uncover the knowledge sharing practices in virtual organisations in Iran. This is very crucial for virtual organisations to develop and improve their knowledge sharing practices.

INTRODUCTION

In today's world of constant competition, the pace of change in knowledge and information is increasing rapidly. Indeed, in this space, an organization would be successful only if it could adapt itself to environmental conditions. These quick changes and environmental variables cause new structures and forms in organisations.

A virtual organization is one of these new modern organisation forms. A virtual organization temporarily is formed by two or several partners and collects required resources in order to achieve specific goals from different fields.

Several types of research have been carried out about virtual organizations. Numerous studies have dealt with these organizations from different aspects, however; knowledge sharing in the virtualorganization has been mostly overlooked. Knowledge in the age of information technology can be considered as one of the most prominent resources in order for organizations to leverage their competitive edge in competitive markets[1, 2]. Research has shown that knowledge which is acquired, collected and stored by people contains a limited value for the underlying organization. Whereas, sharing, composition and unique use of knowledge add value to the collected knowledge[3]. Knowledge sharing is a critical issue for organizations, since, it enables them to develop and to increase their capacity and ultimately to gain a sustainable competitive advantage[4]. A considerable research which has been done in this regard has emphasized the importance of knowledge sharing in the development of products, services and new technologies[5]. This makes knowledge sharing a topic which can be applied to all organizations in both levels of individual and organizational processes[6, 7].

In order to gain competitive advantage, organisations should recruit experienced and skilled staff or alternatively to train them up to the required skills. Although, these measures are necessary, these are not enough and the importance of expert's experience and knowledge transfer to the unskilled and inexperienced people should be considered[8]. Accordingly, it is desirable that organisations put more emphasis on current knowledge-based resources[9, 10].

Irancell can be considered the second largest mobile operator in Iran. Directors of the company intend to implement knowledge sharing systems among employees (as one of the tools of knowledge management system) in order to raise the company's capacity.

The importance of our study is fostered by the advancement of technology which has given rise to the whole new topic of virtual organisations. Research on factors affecting knowledge sharing in these emerging organisations is considered crucial by managers and leaders. This research intends to identify the factors influencing knowledge sharing in virtual organisations as well as evaluation of definitions and various categories of these key factors in order to aid the design and development of effective operational knowledge sharing systems. In addition, this research can aid virtual organisations to increase their innovation and productivity.

Literature review: The importance and processes of Knowledge sharing. All activities related to the distribution or transmission of knowledge from one person or organisation to an individual, group or other organisation are called knowledge sharing[11]. Traditionally, organisations and individuals are often unwilling to transfer and share their own knowledge as they rather looked at the knowledge as a scientific capital or as a source of power and a guarantee of continuation of their jobs and did not want to share it with others. Organisations which support the sharing of information and knowledge among its members could define more effective and efficient processes and improve its organisational performance[12]. In organisations which have established the culture of knowledge sharing, dissemination of ideas and insights occurs naturally among employees because they have voluntarily participated in knowledge sharing rather than following it as a mandatory rule. Therefore, the motivation should be created among the members to engage in knowledge sharing without fear of losing their position in the organisation. In other words, knowledge is defined as the act of publishing information among others by people.

Knowledge sharing is so important in the knowledge management domain that the philosophy of knowledge management is laid upon the concept of knowledge sharing process[13]. Today, the analysis of internal resources has been replaced by focusing on intangible resources among which knowledge is the most important one[14]. Hence, the identification, collection, storage and sharing of knowledge for organisations in order to gain competitive advantage has become an essential subject[15, 16]. Various factors influence the process of knowledge sharing in an organisation. These factors can be structured in four general categories of human, technological, structural and cultural.

Knowledge sharing factors

Structural factors and knowledge sharing: Organisational structure specifies how tasks are allocated, who reports to whom and what formal coordination mechanisms and what organisational patterns of interaction must be met. The internal structure of an organisation can promote or hinder the success of knowledge management[17]. In order for organisations to effectively manage knowledge, they must have a good structure. Literature shows that organisational structure is the factor which can either hinder or encourage knowledge sharing among employees[18]. Three dimensions of formalisation, centralisation and information flow and its underlying communications can be highlighted as key variables that affect the implementation of knowledge management and sharing[19, 20]. These four dimensions are important structural features which its variations directly influence mode, transformation, storage and use of knowledge. These features will be discussed in more detail.

Recognition refers to the extent to which organisational jobs are standard. The extent of official rules governing organisation‘s decision-making process and working relationships defines the extent of organisation’s recognition. Knowledge creation requires flexibility and less emphasis on work rules. When there are tough rules in an organisation, the creation of new ideas is limited while flexibility will lead to better approaches in doing things. Thus, the increased flexibility in the organisation can contribute to the success of knowledge management[19]. The creation of knowledge also requires diversity. When unanticipated problems raise, organisations need to create diversity in their structure and processes. Formalisation reduces innovation. The decrease of formalisation causes a variety of new ideas and encourages new behaviours[21].

Centralisation refers to the degree to which decision making is concentrated in a unit in an organisation. Scientific management focused on job definition and how tasks are accomplished.

In knowledge oriented organisations, information caters to fulfilling various aims and objectives. Extensive sharing of information keeps the performance of the organisation at an optimal level. Knowledge oriented organisations aim to achieve the state of small and entrepreneurial organisations in which all employees have full information about the organisation, so that, they can act quickly. Indeed the ideas and information are spread across the organisation. Managers rather than usingthe information to control their subordinates, seek to find channels through which ideas can flow in all directions. This requires a multi-directional communication flow in the organisation. Hence, facilitating and regulating the interactions among individuals in these organisations is of prime importance. In addition, knowledge-oriented organisations keep open lines of communication with customers, suppliers and even competitors to improve the capacity of their own learning. IT is one way of keeping in touch with people[22].

Different combinations of these three aspects can create different organisational structures[19]. Regarding formalism, knowledge sharing is related to the extent of formal rules and regulations[23]. Some believe that flexibility and less emphasis on work rules, improve the formation, transformation and use of ideas and as a result increased flexibility in organisational structure can help the success of knowledge-sharing[21]. Low formalisation allows members of the organisation to establish proper interactions for the purpose of knowledge sharing. In other words, the structure of the organisation should facilitate the flow of knowledge and allow the knowledge to have a strong impact on performance. Others scholars believe in high formalism to be more fruitful for knowledge sharing[24]. Formalism reduces ambiguities and improves cooperation among staff as they can shape the structure of their interactions[25]. Thus, it can be said that formalism is associated with knowledge sharing.

In the centralization aspect, knowledge sharing is associated with decision-making authority in the organisation. Decentralization structures distribute the decision making authority. In such structures, the creative solutions are increasingly improved. The communication channels of centralized structures are very slow and time-consuming. On the other hand, decentralized structures provide an environment in which employees voluntarily participate in knowledge sharing. Centralised decision-making authority reduces the creative solutions whereas delegation of authority in organisation causes spontaneity, freedom of expression and empiricism. These are the factors that make up the foundation for knowledge creation and transfer. Moreover, centralized structures tend to hinder inter-sectional communications and consequently sharing of ideas since,without the continuous flow of communications, these structures are very slow and time-consuming[26]. Finally, it can be said that without a continuous flow of communication and ideas, the creation of knowledge would not be possible. Negative effects of centralisation and formalisation in individual, group and inter-group levels on knowledge sharing have been approved[27, 28, 7].

Technological aspects of knowledge sharing: Many organisations are keen to improve knowledge sharing within their organisation. To this end, they create a knowledge base for their employees to save all their experiences in relation to the organisation. This will in effect enable another employee to utilise such knowledge base of experiences. There are a number of technologies which are designed to facilitate knowledge sharing. Some of these technologies have certain advantages. For instance, instant communications can be established within a wide geographical range. This is particularly fruitful for employees with limited time who prefer to avoid face to face communications especially with whom they are not acquainted in person. An ideal first step in implementing knowledge sharing could be technology. Effective use of technology can be viewed as a clear sign of top management’s commitment to knowledge sharing[29].

Some organisational strategies take new technologies as the best possible solution to improve knowledge sharing[30]. There are managers who still believe that if the technology is set up correctly in the first place,

consequently, knowledge sharing can be implemented effectively. Both explicit knowledge and implicit knowledge whether formal or informal are shared through a communications channel which is supported by technological capabilities. Strength and capacity of such technologies enhance the organisation's knowledge sharing with more speed and precision[3]. A number of technologies employed for knowledge management include data mining and data warehousing tools, organisational intranets, emails, web applications, etc.[31].

Other studies have also confirmed the role of technological strength, information technology support and IT infrastructure in knowledge sharing[3, 31-34, 7].

Human aspects of knowledge sharing: Knowledge sharing can be defined as voluntary sharing of acquired experiences and skills with others within the organisation. This process can be divided in to three stages of individuals, groups and the organisation as a whole. On the other hand, the courage to share one's knowledge is influenced by numerous factors. Various studies show that human factors that affect knowledge sharing include Sense of competitiveness staff, Enjoyment in helping others and Knowledge self-efficacy[16]. Lee in 2003 and Taylor in 2004 have also studied and confirmed the aforementioned impact[35, 36].

Cultural aspects of knowledge sharing: Organisational culture is one of the most important factors which have been studied in this study. Organisational culture can be defined as values, beliefs, theories, tales, behaviours and goals which are widely accepted in an organisation. Choly and Barling have described that for employees to share their knowledge, they have to be motivated by rewards. The lack of appropriate rewards for the appropriate knowledge sharing behaviour may results less severely than the positively rewarding inappropriate behaviour of refusing to share the knowledge. Rewards can take various forms and need not be limited to monetary rewards[29]. According to a qualitative study on some fifty organisations, long and Fahey have concluded that if deep long-term values of the organisation do not support knowledge sharing, utilising new technologies will have limited effects[37]. Such cultural value results in mutual trust and hence leads to facilitated and more effective knowledge sharing.

Lee Dong-Joo in 2007 and Jiacheng in 2010 have also investigated the impacts of organisational culture on knowledge sharing[38]. Aforementioned studies have categorised cultural impacts into five categories, namely, Trust, Cooperation and Participation, Innovation, Social Network and Justice. Impacts of motivational methods on knowledge sharing have also been confirmed.

Knowledge sharing in virtual organisations and its challenges: A virtual organisation is part of a network of independent organisations which are geographically wide but similarities can be recognised in their mission statements. In such a network, every partner provides its own competitive advantage and collaborates in a semi-stable manner. Products and services offered by a virtual organisation, depends significantly on innovations and to some extent on their customer's demands[39]. In other words, a virtual organisation can be considered as a temporary network of independent organisations which have shared their core competency in hope of improving their value-adding process. These organisations, share their costs, risks and resources and also allow access to each other's markets[40]. Malhotra has provided invaluable contributions on knowledge management in virtual organisations. His book has as two distinct sections. The first part, deals with business innovation, inter-organisational opinions of virtual organisations, inter-organisation knowledge management, knowledge sharing in virtual teams, work environments for virtual teams and virtual models. The second section though deals with transforming traditional organisations to knowledge sharing organisations, integrated knowledge systems, comprehending organisational control, utilising knowledge sharing capabilities with intranets and strategic topics for virtual organisations[23].

Berryman in his PhD thesis titled "knowledge management in virtual organisations, a study on a model of knowledge transformation best practices" has investigated Dickson's proposed model of integrated knowledge transformation systems. He has studied demographical characteristics of attendants, implementation of the integrated system of knowledge transformation, barriers to knowledge and the project results[41]. Langston in his PhD thesis, "The Effect of virtual participation in a community of practice: a study of harnessing knowledge in a virtual world", has investigated the way in which virtual participation in an international organisation can lead to international competition advantage. He has studied to determine the facilitating factors of effectiveness of virtual participants of a community of practice[42]. Lin, etc have studied about forecasting the deterministic factors of knowledge sharing in virtual communities. In their research an integrated model for analysis of the causal effect between conceptual elements, personal perceptions on knowledge sharing

Table 1: The factors extracted from the reviewed literature in a theoretical framework which covers all the researchers and is categorised based on the investigated factors

Factors affecting knowledge sharing	Variables	Researchers
Organisational structure factors		
Formality	The extent of rules and formalities governing decision making work relationships	[21] [19] [24] [20] [18] [27] [25] [28] [7]
Centralization	The extent to which decision making authority is concentrated in a particular part of an organisation	[19] [20] [27] [28] [7]
Communication and information flow	Refers to communication channels through which messaged are conveyed	[19] [20] [16] [28]
Technology factors		
IT support	The use of information technology and the use of technology for its support	[30] [31] [32]
IT infrastructure	Systems such as management information systems, document management systems, Internet, etc.	[34] [31] [32] [33]
High capacity power technology	Technological capabilities	[29] [3] [7] [33]
The sense of competitiveness staff	Competition among employees to achieve better social and organisational ranks	[35] [47] [36]
Human factors		
Enjoyment in helping others	The sense of personal fulfilment achieved through helping others in the organisation	[45] [21] [49] [16] [35] [47] [36]
Knowledge self-efficacy	Personal judgment based on their own capability of helping others	[14] [46] [16] [35] [47] [36]
Organisational culture factors		
Trust	Personnel's' trust to knowledge and information they receive from others	[36] [47] [48] [49] [32] [50]
Realization	The extent of a person's perception of the importance of knowledge sharing	[37] [51]
Cooperation and participation	Team work enthusiasm to achieve common goals	[36] [47] [48] [49] [32] [50]
Reward systems	A system to evaluate the shared knowledge to reward employees	[14] [52] [29] [53] [19]
Innovation	The extent to which management motivate employees to be innovate	[36] [47] [48] [54]
Social network	The extent of personnel's' informal communication through social networks	[36] [47] [48] [54] [10] [50]
Justice	Considering justice and equality in knowledge sharing and information flow	[36] [47] [48] [50]

and knowledge sharing behaviour have been devised[43]. Alavi, etc. have worked on communications development theory to determine four challenges in knowledge sharing integration in virtual team environments. Then, they have went on to suggest a knowledge sharing systems solution to overcome these challenges[44]. Soule in her PhD thesis "Bridging Knowledge Gaps: Knowledge Sharing and Learning Practices in Virtual Development Teams", have collected qualitative information from seven geographically scattered virtual teams. She has then formed a theoretical framework for comprehending ownership and sharing of knowledge[55] (Table 1).

Knowledge bases in virtual organisations are more widespread than other organisations both inside the organisation and outside among suppliers, customers and competitors. Although, this makes knowledge management harder and more significant for these organisations such a widespread existence, offers these organisations a number of benefits such as increased competition which leads to price cuts and as a result, customer satisfaction and loyalty will be increased. Generally, virtual organisations are extremely customer oriented as they rely on customer opinions for their production or service provision. In this type of commercial partnership an organisation instead of creating the knowledge itself, will utilise its partner's knowledge which leads to cost reductions. Mutual trust that is hard-wired in virtual organisation's cultures is key to distribution of knowledge among these organisations.

Irancell company: Irancell company is among the most successful telecommunications companies operating in Iran. Irancell has branches all around the country which are collaborating through virtual communications. Virtual organization" expression was presented in early 80 decades and since then it has been changing. The main characteristics of the virtual organization are based on virtual products; "a product that generates in a moment" but this characteristic is based on it, it has an important function in virtual organization expansion. A virtual organization is often used for purposeful activities. This is the base of the philosophy of these organizations that indicate the difference between a requirement and its resolving methods [56]. A virtual organization is a serious

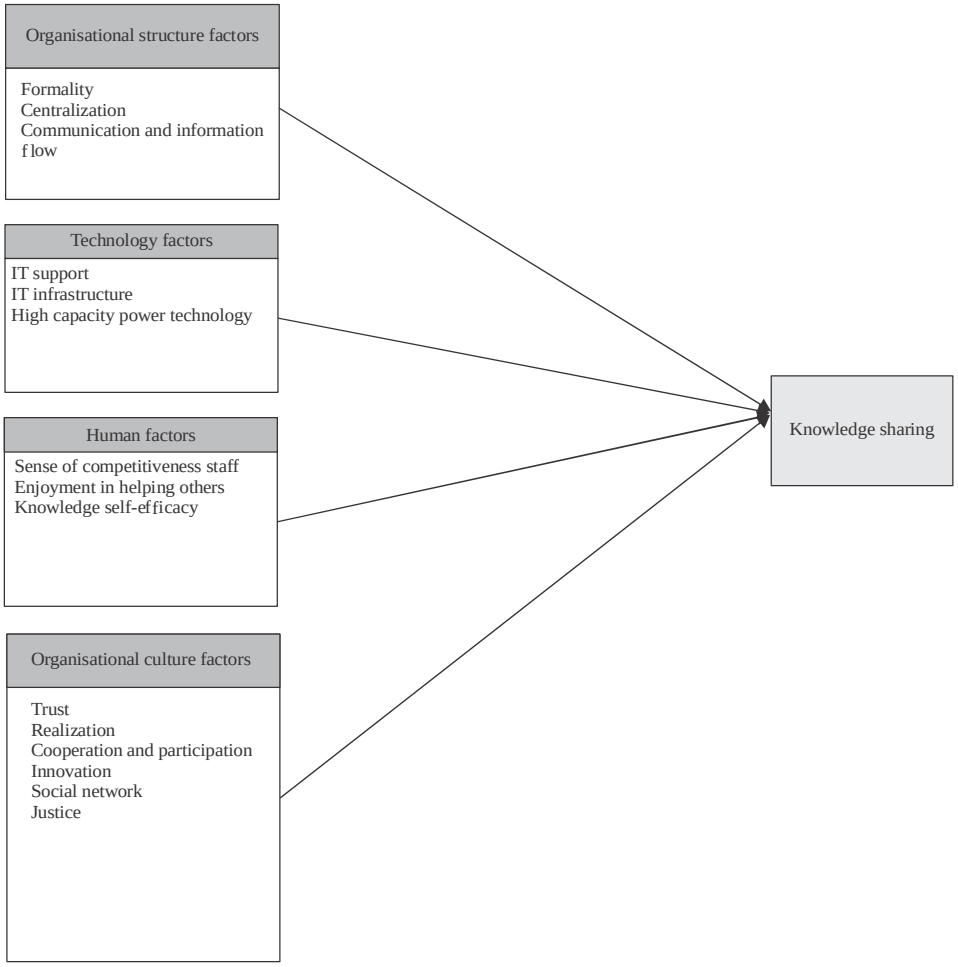

Fig. 1: Depicts the conceptual model which has been inferred from our research

organization that is specified by a temporary set of people or organization sections with geographical distribution, in a way that these groups and sections don't belong to the same organization or inside the organization and also these sections and groups are related each other by electronic communications[57].

Components extracted from the literature on the theoretical framework: Variables in the form of a conceptual model (Fig. 1).

MATERIALS AND METHODS

Research hypothesis: The main question this study aims to address is whether four factors of structural, technological, human and cultural have a notable impact on knowledge sharing in virtual organisations. Hence, the main question can be further divided into four sub-hypothesis as follows:

- Structural factors influence knowledge sharing in virtual organisations
- Technological factors influence knowledge sharing in virtual organisations
- Human factors influence knowledge sharing in virtual organisations
- Cultural factors influence knowledge sharing in virtual organisations

The surveyis chosen as the methodology of this research. Our survey aims to determine and rank factors which influence knowledge sharing in virtual organisations. To this end, we have laid our foundation on the body of literature reviewed in the previous section and then by interviewing experts of the field, key factors influencing knowledge sharing are recognised and a questionnaire has been designed. The process of design and distribution of questions was as follows. Based on

research model and studies undertaken by scholars reviewed in the previous section, questions have been designed and localised. Then, according to expert opinions, questions were adjusted based on the virtual organisation's environment. Next, in a sample including 30 members of Irancell's knowledge management team, the questionnaire has been filled and adjusted through analysis by SPSS Software so the final questionnaire has been designed and distributed to our statistical population of the research. Data gathered through questionnaire were analysed by the following quantitative techniques.

- Factor analysis to determine key variables and factors in order to describe the correlation of the seen variables to determine the validity of the research (Table 1-4)
- Cronbach's alpha to determine the reliability of the research (Table 5,6)
- Kolmogorov-Smirnov test to determine normality of the data (Table 7)
- One-tailed t-test to confirm research questions (Table 8)
- Friedman to rank the variables (Table 9-12)

Table 2: KMO and Bartlett's test

Variables	Values
Kaiser-Meyer-Olkin measure of sampling adequacy	0.8580
Bartlett's test of sphericity/Approx. Chi-square	981.339
Df	190
Sig.	0.000

Table 3: Detecting factor commonalities

Variables	Initial	Extraction
Q1	1.000	0.734
Q2	1.000	0.603
Q3	1.000	0.707
Q4	1.000	0.895
Q5	1.000	0.838
Q6	1.000	0.813
Q7	1.000	0.767
Q8	1.000	0.901
Q9	1.000	0.683
Q10	1.000	0.831
Q11	1.000	0.690
Q12	1.000	0.750
Q13	1.000	0.672
Q14	1.000	0.822
Q15	1.000	0.661
Q16	1.000	0.780
Q17	1.000	0.734
Q18	1.000	0.773
Q19	1.000	0.631
Q20	1.000	0.567

Table 4: Rotated component matrix

	Component			
Variables	1	2	3	4
Q1	0.011	0.825	0.050	0.409
Q2	0.419	0.670	-0.069	-0.146
Q3	0.351	0.796	-0.255	0.104
Q4	-0.181	0.688	0.314	-0.299
Q5	0.735	0.789	-0.358	-0.135
Q6	0.817	0.484	0.052	-0.212
Q7	0.648	0.194	0.289	0.044
Q8	0.798	-0.514	0.105	-0.206
Q9	0.763	0.512	0.808	-0.190
Q10	0.358	0.312	0.694	0.227
Q11	0.352	-0.064	0.748	-0.014
Q12	0.455	-0.377	0.671	-0.130
Q13	0.375	0.128	0.697	0.108
Q14	-0.296	-0.576	0.398	0.704
Q15	-0.170	-0.121	-0.002	0.698
Q16	-0.102	-0.220	0.399	0.695
Q17	0.392	0.131	0.394	0.885
Q18	-0.138	0.237	0.472	0.759
Q19	-0.322	0.127	0.090	0.835
Q20	-0.293	0.167	-0.294	0.456

Table 5 : Case processing summary

Variables	N	Percentage
Cases		
Valid	170	100.0
Excluded(a)	0	000.0
Total	170	100.0

A Listwise deletion based on all variables in the procedure

Table 6: Reliability statistics

Cronbach's alpha	No. of items
0.829	20

Table 7: Kolmogorov-Smirnov test

Parameters	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
N	224	224	224	224	224	224	224	224	224	224
Normal parameters[a,b]										
Mean	8.0938	8.1652	8.0179	8.0893	7.8661	7.4688	7.5625	7.6071	7.9375	6.6161
SD	0.74277	0.70516	0.73335	0.69014	0.92785	0.93219	0.95440	0.83486	0.83940	0.98641
Most extreme differences										
Absolute	0.244	0.258	.0 258	0.275	0.285	0.246	0.284	0.284	0.262	0.216
Positive	0.238	0.258	0.246	0.275	0.197	0.246	.0 180	0.203	0.207	0.216
Negative	-0.244	-.247	-0.258	-0.270	-0.285	-0.165	-0.284	-0.284	-0.262	-0.169
Kolmogorov-Smirnov Z	3.658	3.858	3.864	4.111	4.266	3.682	4.248	4.246	3.919	3.233
Asymp. Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00

[a]Test distribution is Normal; [b]Calculated from data

Table 8: Kolmogorov-Smirnov test

Variables	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
N	224	224	224	224	224	224	224	224	224	224
Normal parameters[b]										
Mean	6.4777	6.7188	6.6295	8.1607	7.6607	7.3482	7.7054	7.3571	7.5804	7.6027
SD	0.86249	0.95945	1.11300	0.66364	1.05076	0.80592	1.01680	1.20058	1.22484	1.09142
Most extreme differences										
Absolute	0.219	.202	0.223	0.283	0.234	0.349	0.293	0.280	0. 259	0.316
Positive	0.219	0.202	0.223	0.283	.0 135	0.209	0.172	0.174	0.143	0.179
Negative	-0.219	-0.187	-0.203	-0.253	-0.234	-0.349-	0.293	-0.280	-0.259	-0.316
Kolmogorov-Smirnov Z	3.279	3.018	3.339	4.238	3.499	5.219	4.379	4.187	3.877	4.732
Asymp. Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table 9: The one-tailed t-test which is used to investigate research questions. That is as all means are >5, all questions are confirmed

Variable name	Results	Mean	t- values
Structure factors	Confirmed	8.1286	98.073
Technology factors	Confirmed	7.6440	87.189
Human factors	Confirmed	6.6105	76.865
Organisational culture factors	Confirmed	7.6307	85.824

Table 10: Test statistics

Variables	Values
N	680
Chi-Square	829.929
Df	3
Asymp. Sig.	0.000

Table 11: NPar test descriptive statistics

Variables	N	Mean	SD	Minimum	Maximum
Structure factors	680	8.0938	0.71701	6.00	9.00
Technology factors	680	7.6440	0.90771	6.00	9.00
Human factors	680	6.6105	0.98654	5.00	9.00

Table 12: Friedman test ranks

Variables	Mean ranks
Structure factors	3.11
Organisational culture factors	2.59
Technology factors	1.59
Human factors	2.70

RESULTS AND DISCUSSION

Data analysis: Considering the results of Table 2, KMO is calculated as above 0.6 (0.8580), data is appropriate for factor analysis. In the next step factor commonalities are detected (Table 3).

The next output of factor analysis is to determine factors which will remain in the analysis. Regarding Table 4, all four factors have been retained in the analysis and based on their influence have been assigned to each of the groups. As illustrated in Table 4 factors can be categorised as follows. Factors 1-5 has been assigned to the structural group. Factors 6-9 have been assigned to the technological group. Factors 10-13 have been assigned to the human group. Factors 14-20 have been assigned to the cultural group. Table 5 and 6 show Cronbach's alpha to determine the reliability of questions. Kolmogorov-Smirnov test has been used to ensure that the sample follows a normal distribution. Test results are highlighted in Table 7. Table 8 shows one-tailed t-test which is used to investigate research questions. That is as all means are >5, all questions are confirmed. According to Previous section (Normal test of variables), it becomes clear that the data did not follow a Normal distribution. On the other hand, ordinal scale (likert) were used in the questionnaire for collecting data. Therefore, it can be argued that we should use nonparametric statistics. In order to rank the factors, Friedman's test has been used. Test results can be seen in below tables. Table 11 indicates the results of rating variables in which structural factors, human factors, cultural factors and technological factors are ranked in first, second, third and fourth position. This research aims to highlight key factors which influence knowledge sharing in virtual organisations. Knowledge sharing is a fundamental tool and concept. Through knowledge sharing, employees aid organisations in gaining a competitive advantage by using and transferring knowledge effectively. To this end, many organisations spend considerable time and monetary resources. Persuading employees to transfer their knowledge appropriately is a key. Employees should be motivated and rewarded in order for them to demonstrate appropriate knowledge sharing behaviour. Therefore, organisations aim to recruit employees that go beyond their formal job definition. This research has concluded that knowledge sharing leads to reduced production costs, shortened project times, more effective group operations, increased innovations and ultimately facilitated achievement of competitive edge. The framework offered

by this study proposes a complete model of key factors impacting knowledge sharing in virtual organisations. According to findings from questionnaire analysis and relating them to reviewed literature, this can be concluded that organisational structure plays the most significant role in knowledge sharing in virtual organisations. As with reviewed literature, concentration, formality and flow of communications and information are known as key elements of the organisational structure. Our finding is on par with those scholars[24, 25]. Who believe that high formality results in better knowledge sharing in virtual organisations. Also, with respect to concentration, it has been realised that knowledge sharing is directly related to decision making authority. Anti concentration structures delegate decision making authority and significantly increase innovative solutions. A non-concentrated structure provides an environment in which employees can voluntarily participate in knowledge sharing. Graham, etc have also agreed with these findings[24]. Finally, as with flow of information and communications, like the conclusion Farhangi, etc have arrived at without a consistent flow of communications and ideas, creation and sharing of knowledge would deem impossible.

The next factor which is investigated in this research is technological and informational which form an indispensable part of virtual organisations. IT and communication tools created by it, play a key role in making communications possible in virtual organisations in which in-person communications may never deem feasible. This research has also confirmed findings of others studies which suggested the increasing importance of such technological factors.

Next factor which was analysed in this study is the human factor. In this area sense of competitiveness among staff, enjoyment of helping others and knowledge self-efficiency have been investigated. Findings obtained by questionnaire analysis have shown that the more competition among employees that is to be promoted both social and organisation wise, the more effective knowledge sharing could be achieved. However, it depends on management capabilities and organisations culture and vice versa, it could lead to opposite outcomes. Also, it has been realised that knowledge sharing capability significantly depends on person's communication skills and social behaviour. The more the joy of helping others, knowledge sharing is facilitated throughout the organisation. The positive impact of the last factor which is knowledge self-efficacy which refers to a person who has the knowledge capability to transfer knowledge to others, has been confirmed. The impact of these factors has also been confirmed by Damanpour[16].

Finally, the impact of cultural factors has also been evaluated. With regard to reviews literature, factors of trust, realisation, cooperation and participation, reward system, innovation, social networks and justice are collectively referred to as cultural factors. Increase in these so-called cultural factors will have a direct positive impact on knowledge sharing. Such a direct impact has also been approved in 4 studies[36, 47, 48, 50].

CONCLUSION

Based on the results of questionnaire analysis and literature review, it can be concluded that organisational culture has a profound impact on knowledge sharing in virtual organisations. According to this, it is strongly recommended to use flexible organisational structure and managerial and communicational systems based on different work groups, delegating authority to employees in order for them to access the required information directly, flexibility in how tasks are done and have the required authority to make decisions in emergency situations and rewarding appropriate team behaviours, providing specific instructions for knowledge exchange in order to guide personnel in their knowledge sharing behaviour.

With regard to the approved impact of technological factors, using the following suggestions is strongly recommended. Utilising hardware (e.g., fax, telephone, computer networks, intranet, internet, etc.). Using software that is update-able and employing knowledge support systems.

With respect to human factors, the following suggestions can be highlighted. Creating a positive atmosphere in which employees are able to healthily compete. In addition, personnel's scientific capabilities should be raised as with cultural factors, design and implementation of an appropriate reward system, creating trust and self-confidence in employees, making sure the information stored in the organisation is correct and up to date, clarifying the communication process, increasing the cooperation and teamwork environment within the organisation. This research has focused solely on four factors of structural, technological, human and cultural. Hence, other influencing factors are omitted. As another limitation, this research has only studied and concluded based on Irancell's headquarter survey and not in its

numerous branches throughout the country. Therefore, another concern is whether the findings of this research can be applied to other virtual organisations. With regard to our former limitation, it is wise for other scholars who are interested in conducting research in this domain to take into account and analyse the role of other factors which are discussed in the literature review. As with the latter limitation, it is recommended to investigate other case studies in order to be able to generalise the research findings to all virtual organisations.

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