

DETERMINING AND RANKING COMPONENTS FOR ASSESSING THE SUCCESS ACHIEVED BY INTER-ORGANIZATIONAL NETWORKS

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Abstract. This research aims to determine and rank factors for assessing the success achieved by inter-organizational networks. After reviewing the theoretical foundations and research background, the factors for measuring the success achieved by inter-organizational networks, including 3 main factors and 38 sub-factors were determined. In the second stage, the validity of factors was investigated by a survey of experts involved in the field of information technology and software and hardware. The results show that factors used in this study are fully approved by the experts of the subject. The results also suggest that IT managers and network engineers need 3 main organizational, network and institutional factors to evaluate the success of inter-organizational networks. Data were tested using Friedman test, one-sample T-test, Smirnov-Kolmogorov and Spearman tests, and Cronbach's alpha was calculated. The results of Friedman's test indicated that from experts' point of view, network factor is the most important one, and organizational and institutional factors were respectively ranked second and third. Regarding each factor, the rank of each sub-factor was determined; hence, in network index, sub-index of teamwork and collaboration has the highest rank. In organizational and institutional indices, the highest ranks respectively relate to sub-indices of software infrastructure and organizing. To implement inter-organizational networks, and evaluate the success achieved by these networks, paying attention to such factors is considered crucial.

Key Words: Network, Inter-organizational Network, Success Factors, Ranking

1. INTRODUCTION

Inter-organizational networks refer to, in fact, a strong and multilateral link among member organizations in a collaborative network with a related field of work, that the main task of inter-organizational networks can be timely transmission of data with an acceptable level of validity and reliability. In fact, inter-organizational networks are considered as very important requirements in today's world, which reduce organizational changing costs, minimize the loss of workforce, eliminate common organizational unnecessary paperwork, increase data security, efficiency and organizational productivity.

In inter-organizational networks, all organizations are themselves customers and suppliers for other organizations; therefore, no operation can be considered by itself. Inter-organizational relationships include relationship with organization and resources. In relation to the market, the amount of activity performed by the organization is discussed against the level of outsourcing. In regard with market relations, some categories such as position of the organization are considered important (Zahir et al. 2010). Along with the evolution and development of organizations, the reality is diminished and inter-organizational relations are strengthened. Six major reasons have been effective on the formation of inter-organizational relationships. These are categories that motivate organizations to interact with other organizations. These reasons are meeting the legal-political requirements, reducing uncertainty in the corporate environment, saving transactions, achieving shared or complementary goals, gaining legitimacy, and maintaining independence and equity (Pallotti & Lomi, 2011).

Due to the necessity and importance of inter-organizational network in the field of IT in the part of literature review, and lack of many available papers' attention to improve inter-organizational networks, the researcher is looking for ways to create inter-organizational networks and improve them. Hence, he will be able to promote the effectiveness and risk management and collaboration maturity that have a great impact on the performance of organizations. As a result, key operations of organizations will be implemented in the best way, and communicating which is a very critical issue in the field of information technology, is carried out more easily and confidently.

2. CONCEPT OF NETWORKABILITY

Networkability refers to the ability and capacity of organizations to be present at networks or to collaborate with other organizations, which can lead to the creation, guidance and development of IT-based business relations (Osterle, Fleisch & Alt, 2001). Networkability is considered as one of the most important capabilities required for organizations in the age of information. Numerous stimuli have made organizations create such capability; some of them are as follows: developing internet using in the business world and in the public sectors, presenting numerous standards in regard with data and information systems, increasing global competition in various industrial fields and emerging new kinds of organizations such as networked businesses, mega-mergers and companies leading in the rapid conversion of ideas to products such as Amazon, eBay, Yahoo, Mysap, and etc.

Networkability enables organizations to promote the efficiency of their business processes, and can quickly enter into new business areas through collaboration with other organizations. Therefore, networkability will increase the competitive strength in organizations through the category of networking, and will lead to enhancing efficiency and effectiveness of processes. It should be noted that the concept of networkability in this research is significant and meaningful in the context of information and communications technologies. In previous studies, only based on business engineering view point and coordination theories, how to create organizational networkability has been regarded important. Accordingly, so far, only intra-organizational capabilities have been considered as factors affecting networkability of organizations which are as follows (Osterle, Fleisch & Alt, 2001):

- Products and services: An organization can enjoy high networkability when its products and services are networkable. In this case, there will be an opportunity to be integrated and combined with products and services provided by other organizations with high speed and low cost. Personalizing services such as Mysap is due to the formability of its information services such as the possibility to determine status information and use of partner's product number.
- Process: Processes with high networkability can be linked quickly to similar processes with low costs, and lead to inter-organizational coordination and collaboration. An automated

request for various catalogs or automatic orders of materials when the inventory level is below the expected amount, are some examples.

- Information systems: Information systems with high networkability can be linked quickly to information systems of other organizations with low cost, and connect with other organizations at system level.
- Employees: Employees with high networkability are considered as prerequisites for creating professional social networks. These are customer-oriented employees who seek to create win-win situations. The criterion for measuring their success is their ability to maintain and establish appropriate relationships with their partners.
- Organizational structure: Organizational structure with high networkability can quickly adapt to new market requirements with minimum costs; such as rapid information of temporary intra-organizational teams, business processes change, or joint implementation of processes.
- Culture: Culture in companies with high networkability creates the capability for organizations to accept great changes, and such companies' collaboration with their partners is based on honesty, rather than mutual interrogation. Therefore, other environmental, inter-organizational or networked factors have not been considered. The research previously conducted on how to increase networkability have been limited to studies carried out at the University of St. Gallen based on the business engineering perspective, and specifically for businesses with the purpose of appropriate, lasting and pragmatic design to implement the category of networkability. Hence, so far, no research has been conducted in public sectors with a behavioral approach to explain and describe the dynamic process of creating such capability.

Since, organizations networkability is considered in the context of "IT-based inter-organizational networks" in the present research, the concept of these types of networks will be discussed in future.

3. CONCEPT OF NETWORK

"Network" refers to a set of networks or interlinked nodes. Therefore, based on the kind of node and type of communication, the title of an important subject has been considered in many scientific disciplines such as strategic management science, organization theories, public administration, social sciences, economics, communication science, computer science, medical services, neurology, physics and even biology and environmental science, and it has been regarded important by these sciences from a particular point of view (Provan, 2007). Hence, network is a general and transdisciplinary concept that can be used in different scientific fields with various meanings. Some scientific disciplines that have applied this concept, along with their examples are as follows (Basole & Rose, 2008):

- Engineering sciences: Transportation networks, television network, satellite network, telecommunication network
- Mathematical sciences: Graph theory and complexity problems
- Social sciences: Social networks
- Medical sciences: Health networks, neural networks
- Political sciences: Innovation networks, learning networks, strategic alliance, networked organization
- Information and computer science: Computer networks, Internet network
- In the following figure, the percentage of using the concept of network in different scientific disciplines has been shown.

In this research, the focus is on new networks that have been created in the common point of two scientific areas of management and computer. Some of these new networks are collaborative networks, smart business network, virtual organizations, and electronic marketplaces.

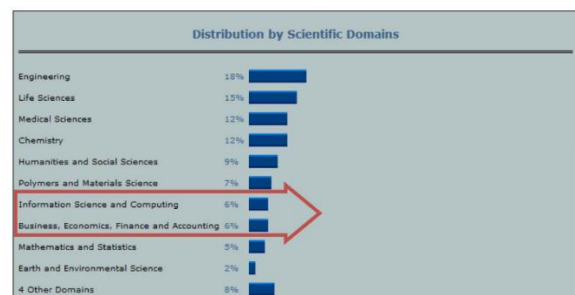


Figure 1. Percentage of applying the concept of network in different scientific domains

On the other hand, different layers for networking can be considered. As shown in Fig. 1, different types of networks can be also considered in accordance with networking layers, which are:

Technology layer: It includes technological networks that connect different technologies such as the World Wide Web (INTERNET), RFID network, WAN, LAN computer networks, and telecommunications network.

Individual layer: It includes networks that allow people to interact and communicate with each other, such as social networks, collaborative networks or inter-organizational networks to create and provide integrated electronic services.

Networks layer: It includes a network of networks that have mutual effects on each other. It also includes regional or international collaborative networks consisting of different networks in different countries, and affect national networks in each country.

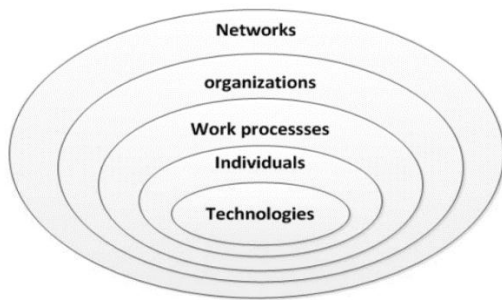


Figure 2. Types of networking layers

In this research, the focus is on organizational layer, namely inter-organizational networks. However, as it is shown on Fig 2. it should be noted that the above-mentioned layers are interrelated. Hence, since inter-organizational networks have been considered in this research, it is necessary to pay attention to mutual effects of technological, individual, processed and environmental aspects. Due to the importance of inter-organizational relations, it will be described in detail.

With the everyday widening of inter-organizational relationships, considering this subject that different disadvantages should be expected during the implementation or analysis of each activity in addition to its benefits, it reminds us that as the proper formation of inter-organizational relationships has many benefits, their improper formation can also lead to irreparable losses in organizations and even their environment. In this regard, it can be very beneficial to recognize the motives for forming

inter-organizational relationships. According to a study conducted by Oliver in 1990 (Oliver, C. 1990), Six major reasons have been effective on the formation of inter-organizational relationships. These are categories that motivate organizations to interact with other organizations. These reasons are as follows:

- Meeting the legal-political requirements (necessity)
- Reducing uncertainty in the corporate environment (stability)
- Saving transactions (efficiency)
- Achieving shared or complementary goals (reciprocity)
- Gaining legitimacy (institutional)
- Maintaining independence and equity (asymmetry)

There are other variables that formation of inter-organizational relations is affected by their context. These variables may play both hindering and facilitating roles. Some of the important variables that affect inter-organizational relations are as follows:

- Degree of mutual trust among organizations: The category of trust among corporate executives and other organizations is a decisive factor in building new inter-organizational relationships. Costs of changing and inter-organizational trust are very crucial in inter-organizational cooperation. If governance structures aim to create equal opportunities, it will make the weaker partners trust more and be motivated to participate. Trust is an important mechanism to control and coordinate inter-organizational relationships.
- Level of participation in regard with goals and interests: When there is a perception that collaboration is the best way to achieve common goals, relationships will be established more effectively among organizations. Compatible goals have the most important impact on inter-organizational collaboration, because organizations make an attempt to build coalition with considered stakeholders to achieve their goals. Hence, organizations with shared interests and beliefs are expected to have a better cooperation in achieving their common goals.
- Similarity in activities carried out by organizations: Organizations may choose

similar organizations to create inter-organizational relationships. Similarity is an important factor in facilitating inter-organizational relations, anticipating behaviors and building mutual trust.

- Cultural difference among partners: According to the cultural cost-benefit theory, peer organizations gradually move towards integration. In practice and in many cases, it is said that organizational-cultural conflict and human involvement have led to insecurity.
- Transparency of goals and expectations: The transparent expectations among partners and relations create the proper conditions for building inter-organizational relationships.
- Presence of a leading corporate: The presence of an initiating factor may be very effective on initiating inter-organizational relationships.
- Complexity and uncertainty in organizational climate: When there are many ambiguities and uncertainty in fulfilling activities and duties, inter-organizational relationships will be top priority. For example, when the buyer and supplier are active in a globalized business environment, they experience the category of uncertainty and rapid change, and for both, learning relationships is vital; value creation is a strategic element of relationship. Hence, influential organizations will try to give an appropriate response to the uncertainty in the competitive environment by increasing inter-organizational links. Therefore, different inter-organizational relationships are expected in accordance with the level of perceptions of organizations from their environment (Ranaei, Zareei & Alikhani, 2010).
- Past and present inter-organizational links: Family-friendly relationships among managers of organizations and membership in unions and social networks lead to facilitating inter-organizational relationships. Therefore, pre-established ties among managers of organizations and stakeholders can be considered as an important factor affecting inter-organizational relationships.

Some of other factors that have been identified in various articles as factors affecting inter-organizational relationships are group control, coordination level, communication quality (strong and effective communications), open communication, long-term and mutual obligations, belief in participation, senior management support and participation, teamwork and collaboration, non-opportunistic behaviors,

flexibility, conflict resolution mechanism, and continuous evaluation. The results of studies show that all factors affecting inter-organizational relationships can be divided into three main organizational, environmental and technological categories.

It should be noted that in this research, the focus is on IT infrastructure-based inter-organizational networks that are created in public sectors. In general, inter-organizational networks created in the public sector can be divided into four categories according to their purpose: 1. Establishing networks to provide integrated services¹ (also called collaborative networks), 2. Creating networks to disseminate information, 3. Creating networks to solve problems, 4. Establishing networks for capacity building in society. As shown in the figure below, the focus of this research is on those inter-organizational networks affected by information technologies and systems that are created in public sectors with the aim of providing integrated electronic services. In the following, one of the examples of these inter-organizational networks, namely single window network is explained. It should be noted that in this research, networkability of several active organizations in single window network will be discussed.

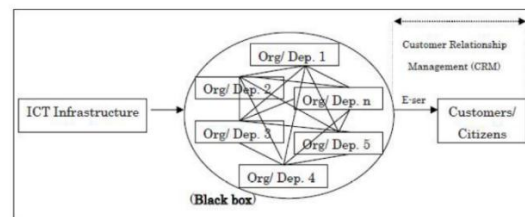


Figure 3. Creating inter-organizational networks influenced by information technology to provide integrated electronic services

4. CONCEPT OF SINGLE WINDOW NETWORK

The creation of single windows is one example of inter-organizational networks affected by information technology to provide integrated electronic services that governments are seeking to establish it in the foreign trade sector. In many countries, active companies in the field of international trade should provide a large amount of information and documents, and submit them to authorities and government agencies in order to complete the process of exporting, importing and transporting their goods internationally. Providing

¹ Integrated Service Delivery Network (ISD Network)

such information and observing such requirements, regarding the costs related to each category, put a lot of pressure on both public sector and business enterprises and lead to serious barriers to the development of international trade. In the meantime, as shown in the figure below, one of the best possible approaches to solve such problem is establishment of a single window by which business firms can provide relevant business information and required documents only once through a single port. This system can enhance access to information and promote its management and accelerate and speed up the flow of information transmitted between business and public sectors, and finally lead to more integration and easy sharing of related data among different government systems. In addition, single window network can provide a framework for improving efficiency and effectiveness of government regulatory processes during implementation of business affairs, and reduce the costs related to public and private sectors for better use of resources. Hence, single window is a commercial facilitating tool that provides significant benefits to business actor by reducing non-tariff barriers.

This research aims to determine components for measuring the success achieved by inter-organizational networks. Therefore, the four main questions of the research are as follows: Which components are applied to measure the success achieved by inter-organizational networks from an organizational perspective? Which components are applied to measure the success achieved by inter-organizational networks from an institutional perspective? Which components are applied to measure the success achieved by inter-organizational networks from a networked perspective? How is each component used to evaluate the success achieved by inter-organizational networks is ranked?

5. RESEARCH METHODOLOGY

In terms of the nature of the research, it is a quantitative study. From purpose viewpoint, it is applied, and from data collection viewpoint, it is descriptive.

Statistical population of this research included experts working in the field of inter-organizational networks. A sample of 52 experts was selected using questionnaire and snowball method.

The questionnaire consists of two general questions:

General questions: In this section, the general and demographic information of respondents have been questioned.

Specific questions: This part of questionnaire contains closed-ended questions using 5-point Likert scale.

To measure content and face validity, a questionnaire including the main components of success achieved by inter-organizational networks, was distributed among experts and professors familiar with the topic, and their opinions were obtained. Its structural problems were identified and necessary corrections were made to satisfy content and face validity. The questionnaire was distributed among experts after approving its validity. The validity of this questionnaire was evaluated by Cronbach's alpha, which can be seen in the table below:

Table 1. Cronbach's alpha

Total number of experts	Number of questions	Test result
52	38	0.886

Because the test result is more than 0.7, the questionnaire is highly valid. Then, data are analyzed in each stage according to research hypotheses.

Data were analyzed using SPSS to describe demographic information and investigate research tests.

6. RESEARCH FINDINGS

Demographic findings

Findings related to data normality

Investigating normal or abnormal distribution of data using Kolmogorov-Smirnov test

This test is used to examine the data distribution of a variable. The normal distribution of data can be investigated using this test in SPSS (Akhavan Mehdi, 2014).

Hypotheses of this test are as follows:

H0: Data are normally distributed
H1: Data are not normally distributed.

The concept of “Significance” briefly shown by “Sig” is the amount of error that is made when rejecting H0. This significance error or Sig is also known as P-Value. The less the Sig value, the simpler the rejection of null hypothesis. In this test, if decision criterion (P-Value) is less than 5%, the null hypothesis will be rejected; namely, the distribution will not be normal. It should be noted that Kolmogorov-Smirnov test is a two-tailed test, and it is better to interpret in this way that significance value is divided into 2, and if this number is more than 2.5%, the distribution will be normal. The results of the test are shown in the table below.

No.	Data group	Mean	Standard deviation	Significance level	Kolmogorov statistic	Accepted hypothesis	Distribution
1	Organizational	4.0385	0.39638	0.732	0.688	H0	Normal
2	Networked	4.0397	0.46830	0.452	0.859	H0	Normal
3	Institutional	3.6474	0.52358	0.540	0.802	H0	Normal

Table 2. Results of Kolmogorov-Smirnov test

Since significance value in all success factors in inter-organizational networks is more than 5%, the H0 is accepted, and data have normally been distributed.

6.1. Findings of research questions

One-sample T-test or statistical population mean

One-sample T-test is used in difference between sample mean and assumed mean (Sarmad, 2005).

The hypothesis test is as follows:

H0: $\mu \geq 3$
H1: $\mu > 3$

H1: Experts agree on the proposed indices.

If the significance value is more than 5%, the null hypothesis will be confirmed, and the variable value is equal to 3; it means that variable status is average. If the significance value is less than 5%, the null hypothesis will not be confirmed.

As shown in Table 4, the significance value for all indices is less than 5%, therefore, by rejecting the null hypothesis, it is concluded that suggested indices are verified by the experts.

6.2. Mean and standard deviation of competencies

Index	Number	Mean	Standard deviation
Organizational	52	4.0385	0.05497
Networked	52	4.0397	0.06494
Institutional	52	3.6474	0.07261

Table 3. Mean and standard deviation obtained from t-test

Tested value: 3		Number of data: 39				95% Confidence interval	
No.	Indices	T	Degree of freedom	Significance	Mean difference	Lower limit	Upper limit
1	Organizational	18.892	51	0.000	1.03846	0.9281	1.1488
2	Networked	16.010	51	0.000	1.03974	0.9094	1.1701
3	Institutional	8.917	51	0.000	0.64744	0.5017	0.7932

Table 4. Result of one-sample t-test in regard with data provided by experts

6.3. Analyzing research questions

Regarding components evaluating the success of inter-organizational networks, 17 factors in regard with organizational perspective, 6 factors in regard with institutional perspective and 15 factors in terms of networked perspective were considered and analyzed using one-sample t-test. In this test, the observed mean of each factor in the statistical sample is compared with its expected mean.

H0: $\mu_3 =$ Null hypothesis: There is no difference between sample mean and expected mean.

H1: $\mu_3 \neq$ Alternative hypothesis: There is no difference between sample mean and expected mean.

The results of one-sample T-test for components assessing the success achieved by inter-organizational networks from organizational perspective are presented in the following table:

Indices	Expected mean: 3					
	Variables	Observed mean	Standard deviation	Mean difference	T-statistic	Degree of freedom
Organization size	3.65	0.79	0.65	5.974	51	0.000
Complexity	3.79	0.98	0.79	5.820	51	0.000
Organization productivity	4.06	0.83	1.06	9.230	51	0.000
Organizational capacity	4.02	0.64	1.02	11.459	51	0.000
Economic efficiency	3.90	0.91	0.90	7.138	51	0.000
Scope of organization in terms of activity	4.06	0.80	1.06	9.507	51	0.000
Organizational maturity	4.08	0.76	1.08	10.178	51	0.000
Shared goals and interests	4.10	0.96	1.10	8.276	51	0.000
Transparency of goals and expectations	4.13	0.71	1.13	11.446	51	0.000
Level of complexity and uncertainty in organizational climate	3.63	0.93	0.63	4.924	51	0.000
Senior management support and participation	4.33	0.71	1.33	13.547	51	0.000
Continuous evaluation	4.17	0.71	1.17	11.977	51	0.000
Hardware infrastructure	4.25	0.88	1.25	10.210	51	0.000
Software infrastructure	4.31	0.85	1.31	11.060	51	0.000
Organizational culture	4.23	0.90	1.23	9.871	51	0.000
Acceptance of Organization	4.21	0.72	1.21	12.081	51	0.000

n's members						
Similarity in organizational activity	3.73	0.77	0.73	6.845	51	0.000

Table 5. Results of one-sample t-test related to components evaluating the success rate in inter-organizational networks from an organizational perspective

The data shown on the table above indicate that there is a significance difference between the observed mean and the expected mean in regard with all factors; hence, the null hypothesis is rejected, and the alternative hypothesis is confirmed. Therefore, with 95% confidence, it can be said that all factors mentioned in the table above are considered as components affecting the success achieved by inter-organizational networks from an organizational perspective.

The results of one-sample T-test from institutional perspective are presented in the following table:

Indices	Expected mean: 3					
	Variables	Observed mean	Standard deviation	Mean difference	T-statistic	Degree of freedom
Organization form	4.06	0.85	1.06	8.976	51	0.000
Number of members	3.63	0.86	0.63	5.298	51	0.000
Geographical distance	3.21	0.98	0.21	1.561	51	0.125
Organization age	3.33	0.88	0.33	2.681	51	0.010
Cultural difference among partners	3.54	0.90	0.54	4.335	51	0.000
Organizing	4.12	0.65	1.12	12.444	51	0.000

Table 6. Results of one-sample t-test related to components evaluating the success rate in inter-organizational networks from an institutional perspective

The data shown on the table above indicate that there is a significance difference between the observed mean and the expected mean in regard with all factors; hence, the null hypothesis is rejected, and the alternative hypothesis is confirmed. Therefore, with 95% confidence, it can be said that all factors mentioned in the table above are considered as components affecting the

success achieved by inter-organizational networks from an institutional perspective.

The results of one-sample T-test from a networked perspective are presented in the following table:

Indices	Expected mean: 3					
	Observed mean	Standard deviation	Mean difference	T-statistic	Degree of freedom	Significance level
Applying parallel power	3.79	0.78	0.79	7.331	51	0.000
Organization's structural position	3.98	0.73	0.98	9.724	51	0.000
Past and present inter-organizational links	3.62	0.97	0.62	4.560	51	0.000
Presence of a leading company	3.60	0.96	0.60	4.501	51	0.000
Group control	4.00	0.79	1.00	9.104	51	0.000
Coordination level	4.19	0.63	1.19	13.703	51	0.000
Quality	4.04	0.84	1.04	8.923	51	0.000
Strong and effective communication	4.21	0.78	1.21	11.265	51	0.000
Open communication	4.15	0.70	1.15	11.939	51	0.000
Mutual obligations	4.10	0.85	1.10	9.341	51	0.000
Belief in partnership	4.33	0.71	1.33	13.547	51	0.000
Teamwork and collaboration	4.46	0.73	1.46	14.506	51	0.000
Non-opportunistic behaviors	3.90	0.89	0.90	7.312	51	0.000
Flexibility	4.06	0.83	1.06	9.230	51	0.000
Conflict resolution mechanism	4.17	0.73	1.17	11.532	51	0.000

Table 7. Results of one-sample t-test related to components evaluating the success rate in inter-organizational networks from a networked perspective

The data shown on the table above indicate that there is a significance difference between the observed mean and the expected mean in regard with all factors; hence, the null hypothesis is rejected, and the alternative hypothesis is confirmed. Therefore, with 95% confidence, it can be said that all factors mentioned in the table above are considered as components affecting the

success achieved by inter-organizational networks from a networked perspective.

6.4. Friedman rank test

To investigate the experts' opinion about the importance of each index, Friedman test is applied.

- H0: There is a significant difference between experts' agreement and indices.
- H1: There is a no significant difference between experts' agreement and indices.

Tables related to the results obtained from Friedman test are as follows:

Statistical index	Calculated values
Number of experts	52
Chi-square calculated	26.020
Degree of freedom (df)	2
Significance level (Sig)	0.000

Table 8. Friedman test output related to indices

According to the results of the test, since the significance level is less than 5% (0.05), the hypothesis suggesting that indices are of equal importance is not accepted. Table 9 shows other results obtained from Friedman test representing mean of ranks related to each index. The higher the mean of ranks, the more the importance of related variable. In other words, those factors are highly approved.

No.	Title of indices	Mean of rank
1	Organizational	2.23
2	Networked	2.34
3	Institutional	1.43

Table 9. Rating Experts' opinions in regard with indices identified

According to Friedman rank test, networked, organizational and institutional index are respectively important.

With regard to Friedman's test results, it can be concluded that to create successful inter-organizational networks, priority is respectively given to the network index and sub-factor of teamwork and collaboration among organizations, organizational index with sub-factor of software

infrastructure to create an appropriate framework for changes caused by creating network, and finally, institutional index with sub-factor of organizing.

6.5. Prioritizing sub-indices available in each category of indices

Like Friedman test assessing each index, each category of indices is selected and tested using Friedman test in order to determine the priority of each factor.

Statistical index	Calculated values
Number of experts	52
Chi-square calculated	74.051
Degree of freedom (df)	16
Significance level (Sig)	0.000

Table 10. Friedman test output related to organizational index

Since significance level is less than 5%, the null hypothesis is rejected, and existence of ranking in the organizational index is confirmed. The ranking is as follows:

No.	Title of organizational index	Mean of rank
1	Software infrastructure	10.75
2	Senior management support	10.71
3	Hardware infrastructure	10.26
4	Organizational culture	10.22
5	Acceptance of organization's members	9.93
6	Shared goals and interests	9.74
7	Continuous evaluation	9.73
8	Transparency of goals and expectations	9.60
9	Organizational productivity	9.28
10	Organizational maturity	8.99
11	Scope of organization in terms of activity	8.80
12	Organizational capacity	8.50
13	Economic efficiency	8.25
14	Complexity of tasks	7.70
15	Similarity in organizational activity	7.08
16	Level of complexity and uncertainty in organizational climate	6.89
17	Organization size	6.57

Table 11. Categorization of organizational competencies

According to the test results in regard with this index, a work network should have the skill of building strong software infrastructure in organizations to create a successful inter-organizational network.

6.6. Institutional index

Statistical index	Calculated values
Number of experts	53
Chi-square calculated	50.571
Degree of freedom (df)	5
Significance level (Sig)	0.000

Table 12. Friedman test output related to institutional index

Since significance level is less than 5%, the null hypothesis is rejected, and existence of ranking in the institutional index is confirmed. The ranking is as follows:

No.	Institutional index	Mean of rank
1	Organizing	4.45
2	Organization form	4.26
3	Number of organization members	3.39
4	Cultural difference among partners	3.32
5	Organization age	2.91
6	Geographical distance	2.66

Table 13. Rating institutional index

According to the results of Friedman test in regard with institutional index, the most important index which should be considered by network engineer is proper organization in accordance with inter-organizational networks.

6.7. Network index

Statistical index	Calculated values
Number of experts	52
Chi-square calculated	88.935
Degree of freedom (df)	14
Significance level (Sig)	0.000

Table 14. Friedman test output related to network index

No.	Title of organizational index	Mean of rank
1	Teamwork and collaboration	10.46
2	Belief in partnership	9.61
3	Communication (strong and effective communications)	8.95
4	Coordination level	8.79
5	Conflict resolution mechanism	8.74
6	Open communication	8.73
7	Mutual obligations	8.27
8	Flexibility	8.20
9	Quality	7.89
10	Group control	7.75
11	Organization's structural position	7.38
12	Non-opportunistic behaviors	7.16
13	Applying parallel power	6.60
14	Past and present inter-organizational links	5.92
15	Presence of a leading company	5.54

Table 15. Rating network index

According to the results obtained from investigating network indices, it was concluded that from experts' viewpoint, the most important factor in this group is teamwork and collaboration. In fact, due to the nature of network, which provides a link for transmission of information, its framework should be created by teamwork to share data.

6.8. Investigating the relationship between demographic variables and variety of indices

In the following, it is tried to examine the relationship between demographic variables related to experts (sex, age, related work experience and field of study) and indices related to inter-organizational networks. According to the results of demographic data obtained from the

questionnaire, it is said that there is a young statistical sample (59% of samples were individuals with less than 30 years of age), holding master's degree (71%). This indicates the novelty of scientific field of inter-organizational networks, as well as high levels of education and academic studies of individuals.

6.9. Spearman correlation test

The null hypothesis in this test refers to the lack of correlation among variables, and alternative hypothesis confirms existence of correlation. To verify or reject null hypothesis, if the significance level is less than 5%, the null hypothesis will be rejected; otherwise, it will be confirmed (Mahdavi, 2014).

The hypothesis is represented as follows:

$$\left\{ \begin{array}{l} H_0: p=0, \text{ (There is no significant correlation} \\ \text{between demographic variables and indices.)} \\ H_1: p \neq 0, \text{ (There is a significant correlation} \\ \text{between demographic variables and indices.)} \end{array} \right.$$

Therefore, in the table below, according to the significance levels, there is a significant relationship between "organizational and network" and "institutional and network" variables with 99% confidence level. A few examples of this relationship identified by experts' opinions, are as follows:

- The more the network' expert is experienced, the more the institutional indices are important for him.
- The higher the level of education, the higher the priority of organizational index
- The more the age of expert, the higher the importance of institutional index for him

The result of correlation test indicates that in most cases, there is no correlation between demographic variables and indices, or the correlation is weak; in other words, a rational generalizable result that can be attributed to society was not found in this test.

6.10. The result of Spearman correlation test

Demographic variable		Spearman coefficient		
		significance level	Network	Organizational
Work experience	Spearman	287.	492.	888.
	Sig	150.-	098.	020.
Sex	Spearman	085.	045.	200.
	Sig	548.	75.	155.
Age	Spearman	213.-	163.	014.-
	Sig	130.-	248.	923.
Degree	Spearman	155.-	034.	133.-
	Sig	271.	811.	349.

Table 16. Spearman correlation test

6.11. The conclusions of this study are as follows:

In order to create inter-organizational networks, three networks, organizational and institutional factors should be respectively considered due to their importance. Also, in the table below, all of sub-factors are specified in order of priority:

Rank	Main factors	Sub-factors
1	Network	Teamwork and collaboration
		Belief in partnership
		Communication (strong and effective communications)
		Coordination level
		Conflict resolution mechanism
		Open communication
		Mutual obligations
		Flexibility
		Quality
		Group control
		Organization's structural position
		Non-opportunistic behaviors
		Applying parallel power
		Past and present inter-organizational links
Presence of a leading company		
2	Organizational	Software infrastructure
		Senior management support
		Hardware infrastructure
		Organizational culture
		Acceptance of organization's members

		Shared goals and interests
		Continuous evaluation
		Transparency of goals and expectations
		Organizational maturity
		Organizational productivity
		Scope of organization in terms of activity
		Organizational capacity
		Economic efficiency
		Complexity of tasks
		Similarity in organizational activity
		Level of complexity and uncertainty in organizational climate
		Organization size
3	Institutional	Organizing
		Organization form
		Number of organization members
		Cultural difference among partners
		Organization age
		Geographical distance

Table 17. Priority of factors and sub-factors

According to the results of the research, the most important factor affecting inter-organizational networks is network index with sub-factor of teamwork and collaboration to create a successful inter-organizational network from network experts' view point. It was expected that this factor is considered as the most important one, because the nature of creating network is data transmission which is conducted through teamwork in order to share resources. The organizational index with sub-factor of software infrastructure gained the second rank. This result indicated that as it was expected, the important index concluded in this research is associated with technical domain. It means that despite two basic human and technical aspects of information technology, technical infrastructures should be first developed and strengthened to create inter-organizational networks, and the human resources aspect should be then taken into consideration. The last priority is given to the institutional index; it means that the nature of organization in terms of organization's size, geographical distance among organizations and organization's age has no significant effect on creation of inter-organizational networks; however, organizing

sub-factor in institutional group has priority over the rest of sub-factors.

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