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STAKEHOLDER MANAGEMENT IN CONSTRUCTION PROJECTS BASED ON SOCIAL NETWORK ANALYSIS (SNA) OF STAKEHOLDERS CONCERNS

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ABSTRACT

The project's stakeholders play an important role in the project success. Thus, the objectives of the project cannot be fully achieved regardless of the stakeholders' needs. Road construction projects are projects where there are multiple stakeholders with different needs, and given that these projects are usually large-scale projects with high costs, the lack of proper management of stakeholders will be very effective on the project success. A direct relationship is found between stakeholders' concerns and the importance of stakeholders. The purpose of the present study is to identify and analyze the concerns of key and more importantly stakeholders in road construction projects. In the present study, interest and power matrices have been used with fuzzy method and expert opinions, as well as types of stakeholders' concerns for stakeholders' prioritization and then more important stakeholders' concerns using social network method have been investigated, key stakeholders challenges have been addressed and solutions to these challenges have been presented.

Keywords: *Stakeholder Concern, Social Network Analysis, Key Stakeholder, Road Project, Project Phase.*

INTRODUCTION

The stakeholder approach concerns the main parties through which the organization would be able to survive with defense and support (Olander, 2007, Li et al., 2012). As specified by the Project Management Institute (PMI), project stakeholders are groups that are involved considerably in a project or those their interests are probably dependent on the results of project implementation or completion (Haughey, 2012).

Various stakeholders are involved in most construction projects. It was verified by numerous studies that lack of stakeholder management is one of the major reasons for project failure (Olander and Landin, 2005). Stakeholder management is one of the major components of project management. In general, ignoring this component will be costly. Authentic stakeholders usually are not involved in the decision making process. Thus, they will have to face the results of higher risk on project success even if they are entirely marginalized; consequently, losses of opportunities and disagreements among stakeholders are expected (Dimitriou et al., 2013).

Each component of the stakeholder management system, like employer, contractor, and consultant plays a motivational role in the project. It is likely that stakeholders face diversity or

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restrictions. Various factors are involved in each development project, which directly or indirectly determine the success of the project. Managing stakeholders is not probably an easy task in a project; addressing their concerns will be even harder when their number increases (Clarkson, 1995). The involvement of stakeholders in the planning of construction projects have been confirmed by preceding studies (Olander and Landin, 2005, Yang and Shen, 2014). A stakeholder is an entity having stakes in a project; he/she is capable of influencing or being influenced by the fulfillment of a focal organization objectives (Freeman, 2010, Olander, 2007). Reaching various interests through its delivery due to its diverse aspects, such as profession, educational level, culture, spatial distance from it, and even gender are the among the reasons that compels a stakeholder involvement in a project (Oppong et al., 2017).
Increased key stakeholders in the project means increased stakeholder concerns. Stakeholders' concerns are an indication of a project complexity; thus, it is vital to consider the key stakeholders in the project are important. Focusing on the key stakeholder concerns and responding to them are essential in the projects. Recent studies have turned their focus on the methods that to manage stakeholder concerns. Road construction projects are among the main construction projects having various stakeholders. In the present study, several stakeholders and their concerns were put for analysis in a road construction project.

LITERATURE REVIEW

Stakeholder Management

Stakeholder management is a component of project management supplemented to the PMBOK in 2012 (Haughey, 2012). A stakeholder is a person or an entity putting an input into the decision-making phase and expects benefits from his/her involvement (Phillips et al., 2003). Li et al. argue that people who potentially influence the project process and/or project success and have positive and negative impacts on their living environment and face direct benefits and/or losses from the project execution are the stakeholders (Li et al., 2012).
Stakeholders involve both external stakeholders like suppliers, customers, governments, competitors, civil society organizations, the local community, and the environment, as well as internal stakeholders, like employees and shareholders (Harrison et al., 2010, Laplume et al., 2008). Stakeholders are interested in the organizational activities and they are capable of influencing or being influenced by the fulfilment of organizational objectives (Freeman, 2010, Donaldson and Preston, 1995, Savage et al., 1991). Freeman (1984) believed that signing the international memorandum at Stanford Research Institute in 1963 gave birth to the stakeholder concept in 1963 (Freeman, 2010). Elias et al. (2002) showed that this concept was developed in the 4 key areas of organizational theory, system theory, corporate planning, and corporate social responsibility (Elias et al., 2002). As new perspectives have been favored, SM theory was debated through expressive, influential, and normative approaches (Jones, 1995) The importance of stakeholders was verified and its typology was subsequently discovered by focusing on a dynamic rather than a static stakeholder environment (Freeman, 2010, Mitchell et al., 1997). Moreover, studies have been carried out empirically in the field of construction using the basic models and underlying theories (Olander and Landin, 2005, Olander and Landin, 2008, Yang et al., 2009, Yang et al., 2011). Numerous researchers have attempted to classify stakeholders in their research (Li et al., 2012, Huang and Kung, 2010, Jergeas and Put,

2001, Bourne, 2011). F For instance, Olander and Landin applied the factors of stakeholder power and interest for to classify stakeholders (Olander and Landin, 2008).

Stakeholder concerns

As pointed out in the preceding section, considering the key stakeholder concerns and addressing them are vital for the projects and improves on their rates of success. The stakeholder approach targets the main parties through which the organization would be able to survive with defense and support (Li et al., 2012).

Some criteria was introduced by Smith et al. in 2016 for the identification of the key stakeholder concerns for Coastal Resource Conservation; they ran their analysis by Multiple Criteria Decision-Making method (Smith et al., 2017). Nalewaik et al. recognized and analyzed 3 significant stakeholder concerns within 4 main groups of stakeholders in 2015 (Nalewaik and Mills, 2015). Nevertheless, they did not consider the issue of stakeholders' likely variations of concern levels at the diverse times of a project. Terry et al. (2011) investigated stakeholder concerns and their conflicts of interest introducing a systematic approach to analyze the stakeholder concerns about construction projects by studying their degree of conflict levels. They highlighted significant differences in the concern levels of diverse stakeholder groups (Li et al., 2012).

A list of stakeholder concerns for construction projects was achieved by Mok et al., in 2016. They ran the analysis by the Social Network Analysis (SNA) method. They first recognized the significant stakeholders and then their concerns independently. Their research considered the stakeholder concerns. It is likely that project stakeholders and stakeholder concerns alter at the diverse times of a project. However, they did not address this issue (Mok et al., 2017). Some research on stakeholder concerns has recognized various concerns such as economic, safety, environmental, political, time, quality, and technical issues (Guo et al., 2013, Zeng et al., 2015, El-Gohary et al., 2006, Ogunlana, 2010, Takayanagi et al., 2010).

Terry et al. recommended a systematic method to analyze the stakeholder concerns for PIC projects by investigating the degree of consensus and/or conflict involved (Li et al., 2012).

Social Network Analysis (SNA)

The emergence of network theory dates back to 1930s. This methodology methodically studies the relational structures of a definite set of actors, by envisaging the structures using sociographs; in addition, it decodes the structural pattern with network indices quantitatively deciphering the structural pattern with network indices (De Nooy et al., 2018). Wasserman and Faust (Wasserman and Faust, 1994), believed that the interconnected elements within this system, as well as the ways that these elements are connected together determine the performance and robustness of a network system. The network methodology has five common stages, namely (1) determining the network limit (i.e. which stakeholders/issues to be included); (2) recognizing and evaluating the interdependencies of network actors ; (3) envisioning the networks; (4) scrutinizing the network structures using network directories; and (5) evolving management actions and policies in response to the analysis results (Yang and Zou, 2014).

Social Network Analysis (SNA) is by definition the process of examining the social structures by applying its networks through the graph theory (Otte and Rousseau, 2002). The SNA of *things*, people, or individual actors referred to as *nodes* within the network, as well as the *relationships* or interactions known as *ties*, *edges*, or *links* connecting them can be used to

specify the networked structures. Actually, SNA can be applied as a suitable tool to analyze the relationship between the different groups in this field (Moreno, 1960). In theoretical terms, this issue has been established by the graph, anthropological and sociological theories (Tichy et al., 1979). SNA have been effectively used to solve stakeholders' problems in any research areas, including managing the construction projects (Mok et al., 2015). Many studies have used social network theory like as follows: it was used for the tactical alliances by Hagedoorn (2002) (Hagedoorn, 2002), analysis of partnerships by Pryke (2004) (Pryke, 2004), and impression measurements of diverse communication means on personnel's ethical mindsets towards construction projects by Ho et al. (2004) (Ho et al., 2004). Also, Loosemore (1998) used SNA to study the interpersonal associations under crisis conditions (Loosemore, 1998) and applied it to.

Social networks bridge the socially significant relationships among social actors. It is possible to analyze them based on the structural patterns emerging among the actors. A social network analyst can structure the relations among the actors into an overall network pattern by going beyond the individual actors' characteristics and identify their position within the network (Scott, 2017, Wasserman and Faust, 1994). It is also possible to prioritize the effects of stakeholders' impacts on the results of a specific body or activity according to their certain feature like knowledge, interest, power, urgency, legitimacy, etc. provides a traditional approach to stakeholder analysis (Mitchell et al., 1997, Turner, 2006, Johnson et al., 2008). SNA provides another approach by recognizing the stakeholders' degrees of impacts regarding their positions and centrality metrics within the network. Yang et al., who finally reached very similar outcomes, divided and compared their effects according to each approach.

Some studies applied SNA to deal with natural resource management, environmental management, and sustainability, such as the following: Vance-Borland and Holley (2011) examined conservation SNA and weaving in Lincoln County on the Oregon coast, United States of America(Morone et al., 2015). Park et al. (2015) introduced a network model that can be applied to choose the sustainable technology from patent documents(Park et al., 2015). Morone et al. (2015) explored the bioplastics productions and highlighted the possible use of bio-waste as feedstock(Vance-Borland and Holley, 2011). Ghali et al., (2016) analyzed the possible role of online social networking for social connections and paving the way for the material flow compatibilities and help the formation of industrial synergies(Ghali et al., 2016); and Kreakie et al., (2016) recommended internet-based social networks that help build stakeholder networks effectively among conservation and natural resource management professionals(Kreakie et al., 2016).

RESEARCH METHODOLOGY

In this study, first, stakeholders of road construction projects and their concerns were identified using questionnaires and interviews. Then, using interest / power matrix and Trapezius Fuzzy method for designing a questionnaire, key stakeholders were prioritized. For this purpose, three experts' opinions were received separately (Table 1). At the next stage, the relationships between the stakeholders' concerns were determined using experts' opinions and Trapezius Fuzzy numbers. We used fuzzy numbers, because the calculations allowed uncertainty of experts' opinions. The results of stakeholder prioritization based on the number

of concerns of each stakeholder are given in Figure 3 and the results of stakeholders' prioritization based on the interest matrix are shown in Figure 4. At the next stage, using social network method, the relationships between the stakeholders' concerns were analyzed and, finally, major concerns were identified for planning. This case study was conducted on one of the road construction projects in Iran. The challenges facing the above project stakeholders were identified based on the relationships between the key stakeholders of the project and finally the identified solutions to the challenges were discussed.

Fuzzy method

- ### *Fuzzy set*

The fuzzy set $\bar{a}$ of the reference set X is denoted by the membership function $\mu_{\bar{a}}(x)$ in a way that each element of the x of set X, matches the real number *in* the interval [0,1], where $\mu_{\bar{a}}(x)$ matches membership function of the membership of x in set $\bar{a}$. Furthermore, fuzzy numbers are quantities which instead of precise values, a particular membership function is specifiedfor them and trapezoidal fuzzy number $\bar{a}=(a_1, a_2, a_3, a_4)$ is specifically defined as equation 1. The shape of trapezoidal fuzzy numbers is represented in Figure 1.

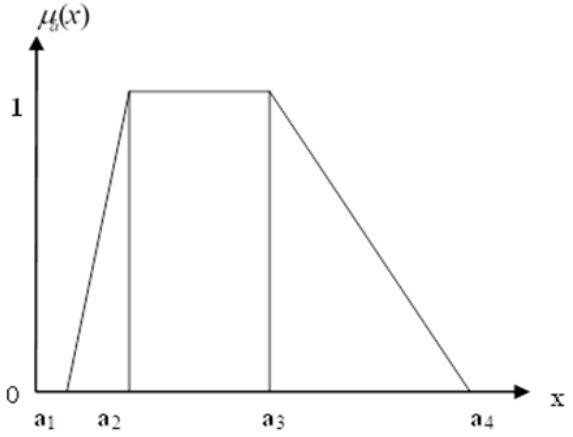


Figure 1. Trapezoidal fuzzy number

$$\mu_{\tilde{a}}(x)=\begin{cases}0 & x<a_1\\ \dfrac{x-a_1}{a_2-a_1} & a_1\le x\le a_2\\ 1 & a_2\le x\le a_3\\ \dfrac{x-a_4}{a_4-a_3} & a_3\le x\le a_4\\ 0 & x>a_4\end{cases} \qquad Eq(1)$$

- ### *Definition of linguistic variables*

As it was specified before, in this paper, linguistic variables are used to model the experts' opinion, which deliver simplification and proportionality with the current condition. In general, it is necessary to apply fuzzy numbers to use linguistic variables. In this study,

trapezoidal fuzzy with extensive application in civil engineering have been used to convert the linguistic parameters to the fuzzy variables. Figure 2 shows the linguistic parameters and their corresponding fuzzy numbers.

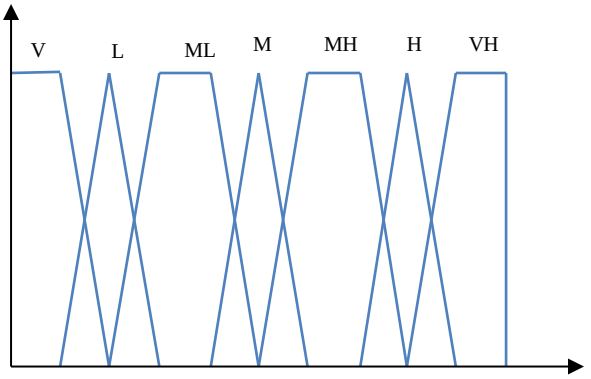
Linguistic parameters	Fuzzy number	Shape
Very low	(0,0,0.1,0.2)	
Low	(0.1,0.2,.02,0.3)	
Medium low	(0.2,0.3,0.4,0.5)	
Medium	(0.4,0.5,0.5,0.6)	
Medium high	(0.5,0.6,0.7,0.8)	
High	(0.7,0.8,0.8,0.9)	
Very high	(0.8,0.9,1,1)	

Figure 2. Linguistic variables

- *Group decision-making*

Given that for major decision-making process, a group of experts would decise, therefore, if the fuzzy rank of the k[th] decision maker is $\tilde{x}_{ijk} = (a_{ijk}, b_{ijk}, c_{ijk}, d_{ijk})$, the final fuzzy rank based on each criteria in the form of $\tilde{x}_{ij} = (a_{ij}, b_{ij}, c_{ij}, d_{ij})$ is:

$$a_{ij} = \min_k \{a_{ijk}\} \qquad b_{ij} = \frac{1}{k}\sum_{k=1}^{K} b_{ijk}$$

$$c_{ij} = \frac{1}{k}\sum_{k=1}^{K} c_{ijk} \qquad d_{ij} = \max_k \{d_{ijk}\} \qquad k = 1, 2, \ldots, K \qquad Eq(2)$$

The result of the above operation is a fuzzy decision matrix as follows:

$$\tilde{D} = \begin{bmatrix} \tilde{x}_{11} & \tilde{x}_{12} & \cdots & \tilde{x}_{1n} \\ \tilde{x}_{2n} & \tilde{x}_{2n} & \cdots & \tilde{x}_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ \tilde{x}_{m1} & \tilde{x}_{m2} & \cdots & \tilde{x}_{mn} \end{bmatrix}$$

If $W = \begin{pmatrix} w1 \\ w2 \\ \vdots \\ . \\ wn. \end{pmatrix}$ is the matrix matching the weights of the criteria, by multiplying this matrix by the calculated matrix in the preceding step, the fuzzy decision matrix will be as follows:

$$\tilde{V} = \left[\tilde{v}_{ij}\right]_{m\times n} = \tilde{D} \times W \qquad i = 1, 2, \ldots, m \qquad j = 1, 2, \ldots, n \qquad \tilde{v}_{ij} = \tilde{x}_{ij} \otimes w_j \qquad Eq(3)$$

Table 1. Stakeholder group in the case road project

Stakeholder code	Stakeholder	Power and Interest						Number of concern
		Expert 1		Expert 2		Expert 3		
		Power	Interest	Power	Interest	Power	Interest	
S1	Employer	VH	VH	VH	H	VH	VH	20
S2	Management and Planning Organization	MH	H	MH	MH	MH	H	9
S3	Opponents	M	VH	H	H	MH	H	8
S4	Investor	H	VH	VH	VH	VH	VH	12
S5	Environmental Protection Agency	ML	H	M	MH	M	M	7
S6	Ministry of Energy and affiliated organizations	ML	ML	M	M	ML	ML	11
S7	Natural Resources Organization	MH	H	M	MH	ML	MH	7
S8	Supreme Council for Urbanism	MH	M	M	M	MH	H	6
S9	Members of Parliament	H	VH	VH	VH	VH	H	9
S10	Regulators	H	H	VH	VH	H	H	8
S11	Contractors	H	VH	H	VH	H	VH	14
S12	Ministry of Economy and Finance	ML	L	L	ML	L	L	8
S13	Consultants	VH	H	VH	H	VH	VH	8
S14	Banking Institutions	VL	L	L	L	VL	ML	9
S15	Municipality	H	MH	H	M	H	MH	4
S16	General public	M	H	ML	H	M	MH	7
S17	Traffic Organization	H	VH	H	VH	MH	H	6
S18	Suppliers of materials	M	H	M	MH	M	MH	7

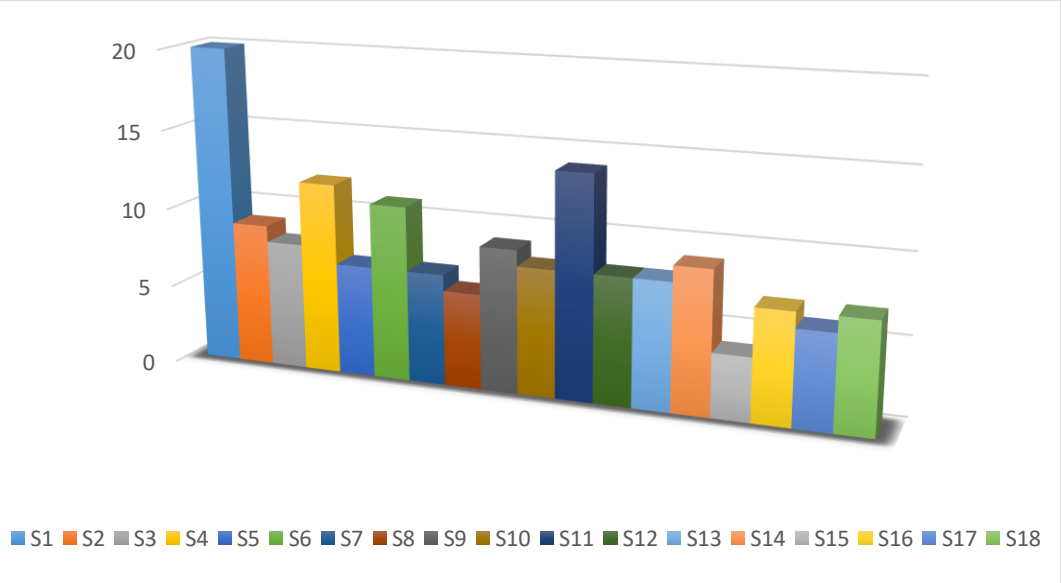


Figure 3. Ranking the stakeholders according to number of concerns

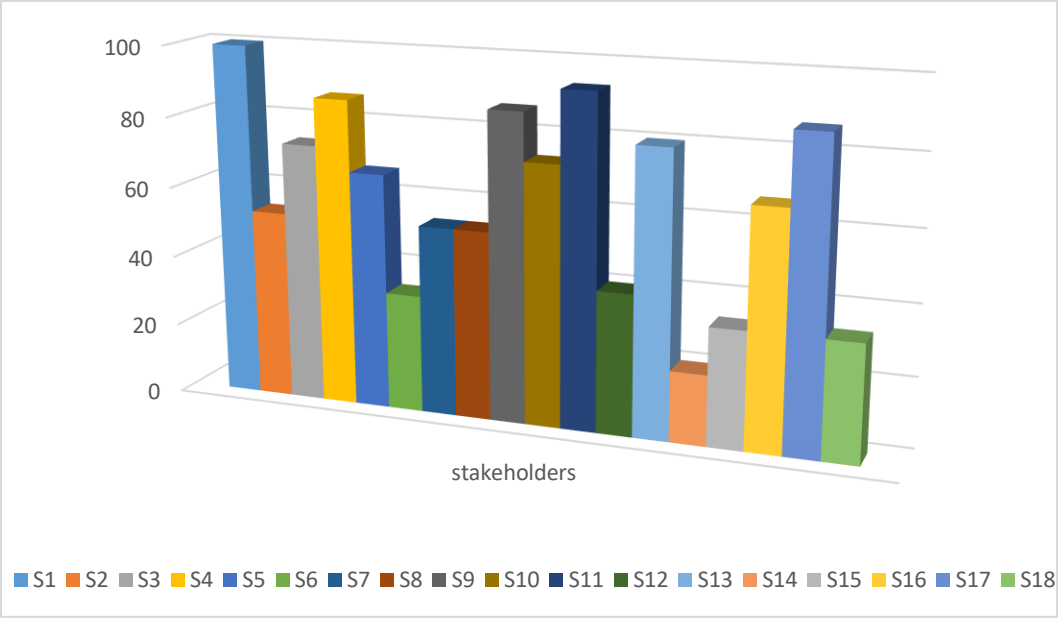


Figure 4. Ranking the stakeholders according to expert opinion

Case study

In this study, out of 43 recognized stakeholders in road construction projects, 18 main stakeholders were first singled out based on the experts' opinion. The concerns of these stakeholders were recognized using an open interview method and a questionnaire. Ultimately, 112 concerns were classified into 8 groups as follows: cost, safety and environment, ethics, information, management, politics and standards, quality, and time.

Next, an inclusive questionnaire was devised and handed over to the stakeholders to have the feedbacks and evaluate the interdependencies between the stakeholder concerns in the project. Trapezoidal fuzzy numbers were used to express the quantity of the results of the questionnaire. Following the defuzzification method, NetMiner-4 was used to explore the relationships between the stakeholders' concerns. Moreover, The power and interest matrix was applied based on the expert opinions and the frequency of stakeholder concerns determined, and the involvement of the stakeholder was prioritized. The required data in this paper was gathered following designing a questionnaire and receiving expert opinions and the results included a list of the recognized and categorized key stakeholders, their diverse concerns, and the relationships between them. In order to achieve the network in the present study, the recognized key stakeholders' concerns were extracted as the network nodes using their representatives' views. At this stage, 112 independent concerns were detected. Table 1 lists the concerns of each stakeholder. As this Table shows, 160 nodes are identified for project of the network as S_iC_j, in the respective order, where i denotes the stakeholder's number and j shows the concern number of stakeholder i.

Next, the links were highlighted through determining the extents of a stakeholder's concerns in comparison with other concerns. This relationship was completed through the questionnaire. To this aim, qualitative values (very low, low, moderate, high, and very high) were used in the questionnaire. The fuzzy theory was used to determine the quantity of the

qualitative results. Ultimately, 662 links were recognized for case of project, respectively. In the present study, NetMiner 4 was applied software the concern network analysis and the software was run based on the information obtained from the previous steps. Figure 2 shows the network of the case. Since information was limited in other phases, only the information outputs are shown in Tables 2-7.

The network complexity is highlighted by the internal relationship between the network nodes. As shown in Figs. 2 and 3, in contrast to external stakeholders, internal stakeholders have considerable importance. Moreover, the network complexity and diversity is mirrored through the various stakeholders with their different concerns in the network center. Furthermore, the concerns of financing, environment, and quality discussions the main issues of the network (Fig. 3), whereas the employers, contractors, and consultants' concerns, as well as concern for environmental organization have more importance.

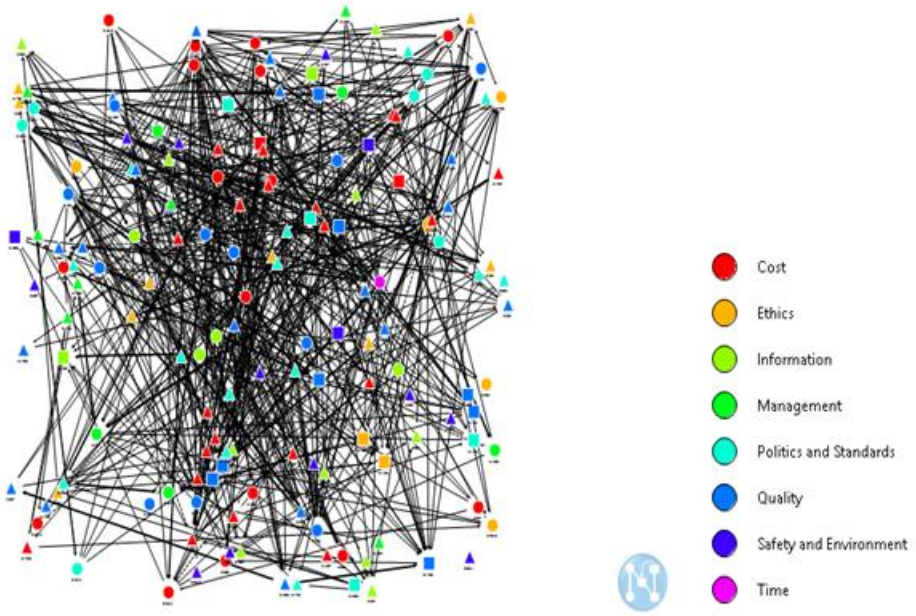


Figure 5. Stakeholder concern network. Note: Circle: Contractual/Internal; Triangle: Non-contractual/External; Square: Non-contractual/Internal

DATA ANALYSIS AND RESULTS

As shown by the previous studies (Li et al., 2016, Yang and Zou, 2014, Yang et al., 2016) various indicators (out-degree, degree of difference magnitude, ego network size, betweenness centrality of nodes, out-status centrality, and brokerage) have been applied to explore the network results. The key concerns of the stakeholders were recognized, whereas 5, according to these indicators (Table 2), more important concerns have been recognized.

In addition, according to Figure 6, based on repeated important concerns based on the afore-mentioned indicators, key stakeholders' concerns were prioritized. According to this classification, the completion of the project at a specified time as one of the important employer concerns (S1C1), achievement the project needed resources as another important

employer concern (S1C3) and contractor failure to perform technical obligations (S1C2) are more important than other stakeholders' concerns.

Ultimately, according to the link betweenness centrality index as shown in Table 3, more important links were identified. In addition, as shown in Table 2, another type of stakeholder prioritization has been investigated using the frequency of stakeholders. S1, S4, S7, and S18 are more important stakeholders. Using the more important relationships, challenges were identified according. Besides, drawing on the interviews with the experts as displayed in discussion part, the response strategies were introduced and recommendations were made for the responses to the challenges according to the experts' opinion.

Table 2: Ranks of the stakeholders concerns

Time Scale	Rank	Concern of Stakeholder	out degree	Concern of Stakeholder	Degree difference magnitude	Concern of Stakeholder	Ego Network Size	Concern of Stakeholder	Node betweenness centrality	Concern of Stakeholder	Out-status centrality	Concern of Stakeholder	Brokerage
T3	1	**S1C1**	359	**S1C3**	292	**S1C1**	28	**S1C1**	0.1029	**S1C3**	3.2109	**S1C1**	148
	2	**S1C3**	354	**S4C7**	241	**S1C3**	27	**S4C5**	0.1066	**S1C1**	3.0461	**S1C8**	111
	3	**S1C2**	218	**S1C1**	215	**S1C8**	22	**S1C10**	0.089	**S1C8**	2.3758	**S1C2**	104
	4	S1C4	216	S4C5	192	S1C5	22	S1C8	0.0806	S1C7	2.1353	S1C5	103
	5	S1C5	212	S11C6	181	S4C5	20	S1C2	0.0756	S1C2	2.0928	S4C2	90

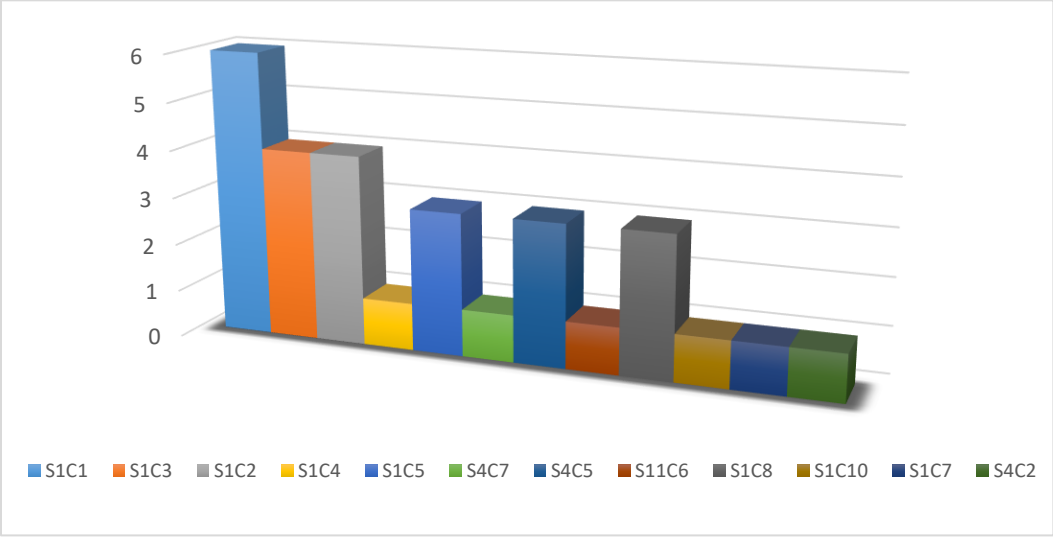


Figure 6. Frequency of the stakeholders concerns base on various indicators

Table 3. The key concerns and interactions according to the betweenness centrality

Link	Betweenness centrality	
S18C6	**S1C1**	1,058.50
S11C5	**S1C3**	514

S1C8	S1C2	775.5
S1C8	S4C2	413.1
S11C7	**S1C2**	548.6
S4C5	S1C10	1,444.80
S4C7	S1C4	899
S1C10	S2C9	708.7

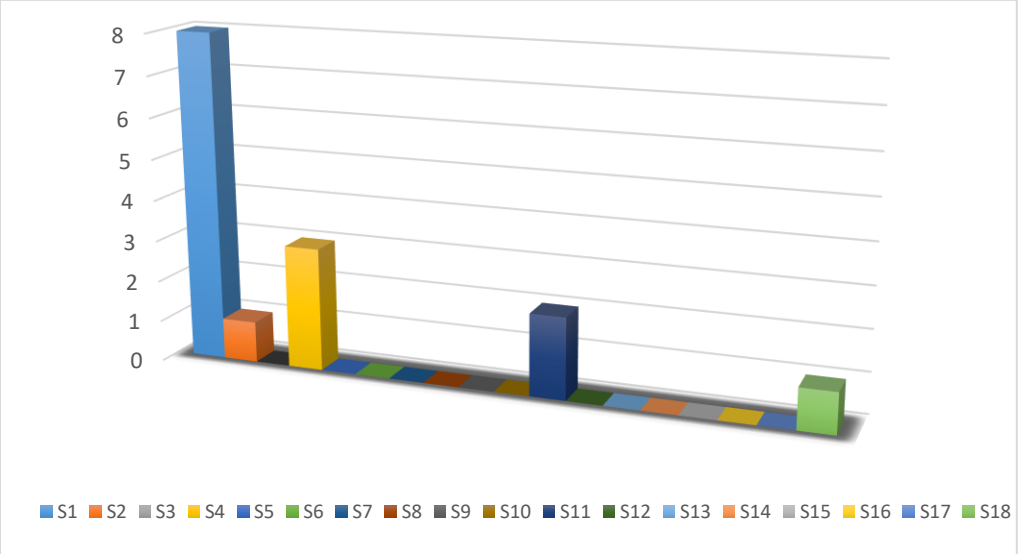


Figure 7. Frequency of stakeholders according to concerns link (Table 3)

DISCUSSION

Failure to complete the project at a specified time is one of the important concerns of the employer (S1C1). The increase in the duration of the project due to financial problems is also a major concern for material suppliers (S18C6) that the relationship between the above concerns is that the prolongation of the project and lack of payment to suppliers of materials will increase the concern of employers that the project will last more.

The contractor failure to perform technical obligations (S1C2) and foreign sanctions (S1C8) are among the important concerns of the employer as well as distrust in contractors (S11C7) is a major concern of the contractors. The relationship between these concerns is that distrust in the contractor's performance during the implementation of the project will increase the concern of employers about failure to perform contractual obligations, as well as the problems caused by the sanctions, which cause concern about the inability to perform the implementation tasks in accordance with the obligations.

The lack of access to the project necessary resources as another important employer concern (S1C3) is related to the employer's concern about sanctions (S11C5), and the relationship between these concerns is that the sanctions problems raise concerns of lack of access to the project needed resources.

Another important concern for the employer is incorrect estimates of time and cost of the project (S1C4), which is directly related to the investor's concern about the lack of return on

investment (S4C7). In case of non-return of capital, the employer's concern about the lack of implementation of the project at a specified time and cost will be increased.

One of the important concerns of the investor is the supply of financial resources (S4C2), which has been related to concerns about foreign sanctions imposed on the employer (S1C8), and with increasing foreign sanctions, the investor's concern for attracting capital from abroad will be increased.

One of the common concerns between employers and investors (S4C5 and S1C10) that interact with each other is political interaction of non-project factors in construction projects that cause employers and investors to be worried about the effect of external factors on the project.

Inefficient executives are also one of the main concerns of Management and Planning Organization (S2C9) that is directly related to the political involvement of the employer (S1C10) and political involvement can be a source of concern for non-project representatives in the selection process for managers.

Suggestions for giving a response to the challenges were made according to the experts:

i. Decreasing the effects of political factors on the project performance

One of the stakeholders' concerns was associated with the effects of political factors on the fulfilment of the project aims. Political issues can be put into two parts: politicians' (some members of the parliament) who meddle with the project to reach their own objectives and the inflation (a much more important problem) because of sanctions and foreign political factors that result in costly project and increased the project budget. Moreover, another issue is the lack of financial resources that lead to the project postponement or causes any other problems. To over this problem, it is necessary to predict the formerly defined risks and their likely solutions. In addition, the project should be implemented by the maximum power based on the timetable to decrease these effects.

ii. Hiring knowledgeable contractors and consultants and choosing contractors according to competence

Another concern of the project stakeholders is inadequate experience in all phases of the project. It is likely that lack of experience prolongs the project time and decreases the fulfillment of technical contractors' obligations that brings about different concerns among the project stakeholders. To overcome these problems, the experts and experienced consultants should supervise all the stages of the project and individuals with particular knowledge should carry out the project's study and implementation operations. Decreased quality of the project is another result of the lack of executive experiences. If the project is of low quality, public dissatisfaction and increased the project cost at the time of utilization are expected. For this reason, measures should be taken to use the restricted financial resources and examine the material in a way that the reduced quality of the project in different sectors is avoided.

iii. Careful estimations of the time and cost of the project

One of the main concerns of stakeholders initially is the precise estimation of the project cost and time. Inaccurate estimations of the project's budget and cost influences financing the project in the execution phase negatively that lead to several adverse results like postponements and disagreements between the various agents of the project, as well as the users' dissatisfaction. To overcome this problem, the details of the project should be explored precisely in the study phases; besides, it is necessary to predict the project cost and time with

the least error in the execution phase. It is also necessary to update the project financing and scheduling and predefine resources financing.

CONCLUSIONS

The key stakeholders of the project as the main elements of the project can affect the achievement of project objectives. In the present study, based on the evaluations carried out in accordance with Table 1 and Figures 3, 4 and 7, the key stakeholders were identified and introduced as the main employers, investors and contractors, as well as the environmental organization. On the other hand, key stakeholder analysis is one of the most important stages in project stakeholder management. The social network analysis method was used to analyze the project evaluated stakeholders. According to Tables 2 and 3, the main concerns of key stakeholders were identified and the potential challenges of the project due to these concerns were examined.

According to the results and frequent concerns at different stages of the project, the main challenges facing the project stakeholders are related to the lack of financial resources and the lack of experience and effects of political problems on the project, which can have a negative impact on the project implementation process.

At the project's implementation stages, foreign policy pressure and sanctions, high inflation is among the most important challenges of the project, and the project will face many problems if the response strategy is not predicted.

For each of the challenges mentioned in Discussion section, there are some solutions that disregarding these concerns could lead to irreparable damage to the project.

According to the results, the number of stakeholders and their concerns, and even the degree and type of relationship between stakeholders' various concerns at different times of the project, is different. Hence, the stakeholders' management process in the various project periods should be continuously reviewed and updated. Therefore, it is recommended to use dynamic planning methods in future research to evaluate stakeholders.

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