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IDENTIFYING AND EVALUATING THE STAKEHOLDER'S EFFECT ON THE COST OF CONSTRUCTION PROJECTS USING THE FUZZY-COQ METHOD

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ABSTRACT

Given the nature of the construction projects, there is a clear presence of diverse stakeholders in such projects. The lack of planning and management of stakeholders in construction projects results in failure to achieve project goals and failures in projects. Therefore, management of stakeholders in construction projects as one of the areas of project management is inevitable. The performance of different stakeholders can impose indirect costs on the project, which can be prevented from imposing overhead on the project, if carefully planned to meet the needs of the stakeholders. In the present research, the goal is to identify and evaluate key stakeholders of the project using the COQ method based on the amount of potential costs that can be imposed on the project. In this method, the costs of the stakeholder performance in the three groups of prevention costs, evaluation costs and failure costs in the construction projects by designing different questionnaires and using a trapezoidal fuzzy method to quantify the questionnaire information are identified and stakeholders are prioritized according to the amount of costs imposed on the project.

Keywords: *key stakeholders, stakeholder management, COQ, fuzzy numbers, construction projects.*

INTRODUCTION

One of the important issues is the design of strategic planning as well as the process of implementing a construction project that recognizes various project stakeholders.
Stakeholders can have high levels of management than ordinary people of society and residents near the project site. Managing stakeholders is complex and necessary at the same time due to the existence of diverse stakeholders. Considering that it is not possible to pay attention to all project stakeholders, real and legal individuals who have important and essential effects on the project are more important and planning is planned to meet their needs, which we call them key stakeholders.
An analysis of stakeholders and stakeholder relationships is essential to directly affect the success of the project (Achterkamp and Vos, 2008). This will help project managers and project managers identify the main stakeholders of each area and learn about the needs and consequences of their needs, as well as their effect on the project so that they can be controlled and managed.
Several studies have been carried out on the importance of stakeholders and how they are managed, which are more about identifying and evaluating key stakeholders in the project.

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Since analyzing the expectations of stakeholders and the financial implications of them is necessary, comparing and managing these financial consequences is considered to be a major issue that has been less appreciated.

The most basic steps for managing stakeholders is to identify all stakeholders of the project and then identify key stakeholders from all stakeholders, but identifying key stakeholders alone is not a factor in project success. It should, in future, evaluate the expectations, needs and performance, and the financial consequences of the stakeholders' behavior in the project.

Obviously, the operation and behavior of each beneficiary can have an effect on the costs and revenues of the project, and since this requires quantitative parameters, one should look for a way that the qualitative consequences of the stakeholders can be presented quantitatively so that it can be used data in project management and financial resources. In this research, the COQ method is considered as a powerful method for identifying indirect costs which is effective in the project, the significance and effect of each beneficiary's performance is evaluated on project costs (Srivastava, 2008).

Using this concept is important because it is understandable for managers and other stakeholders in the project as it affects operating costs and profits, as well as stakeholders' needs (Srivastava, 2008). This concept has been used more in terms of the success of manufacturing companies and commercial services (Carr, 1992). The purpose of the present research is to extend the concept of COQ as a successful tool for managing stakeholders in construction projects, including road construction.

COQ emphasizes quality. Quality is subject to the requirements and standards of construction and complete planning. Therefore, it is an effective parameter for quality (Dalibi, 2016).

LITERATURE REVIEW

Stakeholder management

Freeman introduced the 1984 "Strategic Management" publication: The approach of stakeholders, the theory of stakeholders. Subsequently, decomposition and how stakeholders' influence was considered on management processes and decision making (Freeman, 2010).

Littau has become more important by developing this theory as the stakeholder theory in project management (Littau, Jujagiri and Adlbrecht, 2010).

According to the definition of the stakeholders, from the perspective of the PMI Project Management Institute, the beneficiary is the individual, group or organization that may be affected by the decision of the activity or the outcome of a project, the stakeholders may be so active in the project or have interests that may be affected positively or negatively by the performance or completeness of the project (Drob and Zichil, 2013).

Yang indicates that stakeholders' participation has an effect on project outcomes, and therefore stakeholders' management is important (Yang, 2014).

MCP projects managers are always faced with challenges during the process of identifying stakeholders and their needs, and assessing the effects of each beneficiary on project results and their relationships, as well as creating a strategic plan for interaction between different stakeholders (Yang et al., 2011).

On the other hand, the lack of attention to stakeholder relationships can lead to risk in the project, as Aaltonen and Sivonen believe that one of the most important unforeseen risks is the differences between stakeholders and the resulting incidents (Aaltonen and Sivonen, 2009).
Also, Vard and Chapmen consider stakeholder expectations and communication at each stage of the manufacturing process as one of the most important management problems of stakeholders by studying the risks of building projects and believe that stakeholders are the most important factors of uncertainty in the project (Ward and Chapman, 2008).
Also over the last few years, many articles have evaluated and confirmed the importance of the stakeholders and their role in the project and their influence on the project's results (Achterkamp and Vos, 2008; Littau, Jujagiri and Adlbrecht, 2010; Oppong, Chan and Dansoh, 2017; Mok, Shen and Yang, 2015; Di Maddaloni and Davis, 2017; Chan and Oppong, 2017; Aaltonen and Kujala, 2016; Nguyen, Mohamed and Panuwatwanich, 2018).

COQ Method

In short, COQ is the sum of all resources consumed by an organization, in order to achieve the desired quality in accordance with standards or beyond the relevant standards (Bamford and Land, 2006).
Various models have been proposed in the COQ area. Joseph Juran introduces quality costs as " gold in the mine " and it divides the costs into tangible and intangible parts using this definition (Feigenbaum, 1951).
Following Joseph Juran in the field of quality costs, the traditional PAF model was first Provided and developed by Feigenbaum (1956). Chavez and Broydes categorize COQ categories into (1) George's model; 2) Lesser's classification; 3) PAF model; 4) Quality economics model; 5) Business management and COQ; 6) Modified model by Joseph Juran (Sandoval-Chavez and Beruvides, 1997). Banasik conducted studies in field of quality cost in 2009 during which the COQ models are divided into 9 sections (Banasik, 2009).
Schiffauerova and Thomson (2006) have categorized COQ models into four general models: 1) Crosby's model or PAF model (Prevention-appraisal-failure). 2) Cost opportunity model: opportunity cost models 3) Process cost models (PCM) 4) ABC method of activity-based cost models.
The opportunity cost models are associated with the costs of lost opportunities and the consequences of those opportunities (Tang, Aoieong and Ahmed, 2004). The PCM model follows the costs of the quality project, using the full costs of the project and focusing on the cost involved (Raz and Elnathan, 1999). The ABC model measures activity-based costs, income and expense relative to activity, and evaluates the actual cost (Raz and Elnathan, 1999). In the present study, the PAF method has been used. According to the PAF model, quality costs are divided into three parts: prevention costs, evaluation costs and failure costs (Feigenbaum, 1956; Pheng Low and Yeo, 1998).
Campanella has proposed definitions for each of the costs of prevention, evaluation and failure:
Prevention costs: All costs incurred to prevent failure (low quality).
Evaluation costs: The costs associated with evaluating and matching activities with specific requirements and standards.

Cost of failure: The costs of non-compliance or defect are determined by specific requirements and standards that are divided into two parts of the internal failure (before reaching the customer) and external failure (after reaching the customer) (Feigenbaum, 1951).

Crossbody, by introducing compliance costs and non-compliance costs in the PAF model, has divided the costs into two parts: 1) compliance costs for the correct works, such as evaluation, and the other part, as the costs of non-compliance with the costs of inappropriate works (Crosby, 1996).

Porter and Rayner by carefully evaluating the previous literature classify quality costs into two categories: (1) Decrease in failure by increasing investment in the evaluation is possible. 2) Decrease in failure is associated with an increase in investment in preventive activities (Porter and Rayner, 1992). Application of cost of quality and measurement of costs in construction projects is difficult due to the complexity of the construction process (Aoieong, Tang and Ahmed, 2002). Quality depends on the requirements and standard of construction and complete planning, and the way of work and constructionactivity is a factor affecting quality (Dalibi, 2016). Poor quality information can improve quality management and can be used to measure the performance of construction companies (Ofori et al., 2000).

The costs of quality in construction projects is based on four types of costs, all of which are shown as cost of quality as a percentage of construction incomes (Mwamila and Karumuna, 1999).

In 2009 Rosenfild studied the costs of quality in construction projects and evaluate quality costs with low quality costs.

Irani et al. have proposed a model called PROMQACS using the concept of COQ that can be used to calculate the cost of quality in construction projects.

Application of the cost of quality and implementation of the program in the companies reduces their costs in such a way as to reduce the costs of the review (Rodchua, 2006).

In the various researches, a list of the criteria for influencing project costs has been identified which has been attempted to choose the main factors affecting the quality of COQ. An example of the criteria identified in previous studies is shown in Table 1 (Abdul-Rahman, 1996).

Table 1. Identified criteria in last research

Symbols Parameters	Factors from literature review
PCP	Planned COQ for the project
AQP	Awareness of quality for the project team
STE	Supervision team experience
LS	Labor skills
PL	Project location
S	Suppliers
DE	Design errors
DM	Defected material
PIQ	Plan of improving quality
EF	External factor
A	Accident
ET	Equipment down time
PD	Project duration

Another list has been developed in this regard, with parameters have been added to the main list, which are the result of study of researchers' previous activities on the cost of quality construction processes. These parameters are initially a list of criteria that have been collected as initial data in the opinion of experts, and then the effect of parameters on the cost of quality in the construction process have been measured by experts in this field and ultimately, the list of identified parameters has been compiled as follows: Project duration, Supervision team experience, Planned COQ for the project, Project size, Awareness of quality for the project team, Class of contractor, Client type, Labor skills, Project Type (Tawfek et al., 2012).
The effect rate of each of these parameters has been classified into four parts, considering their effects on the cost of quality.
In another study, they have devised a methodology for calculating the cost of quality and its use in a particular case, using the views of domestic and foreign experts and designing questions in the context of the existing modes for the project such as certainty and uncertainty and effective factors have been surveyed on quality costs in each case and over the different years. Respondents from domestic and foreign experts have been given different weights which show their effect of their views on the amount of costs (Martínez and Selles, 2015).
Another research has been done on the cost of quality COQ in the construction industry, So that the selected list of new influential factors on the cost of quality has been provided. In the first place, the costs of the construction process were studied and the criteria for them were extracted (Al-Hazim, Salem and Ahmad, 2017; Çelik, Kamali and Arayici, 2017). Then, to add again new criteria, we gathered the parameters that affect the quality cost in the field of construction using the questionnaire.

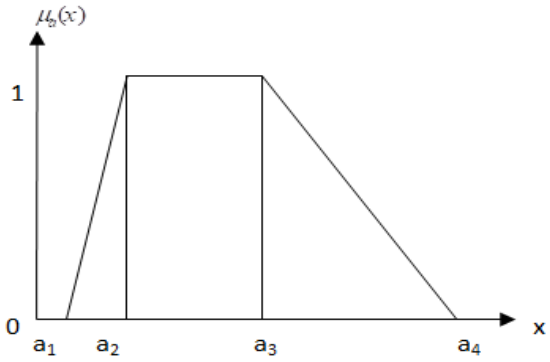
RESEARCH METHOD

In the present study, at first the initial list of stakeholders was identified based on interviews with experts and questionnaires. The initial list of stakeholders included 43 stakeholders in different fields. In the next step, the stakeholders list was extracted by designing a questionnaire, which included 18 beneficiaries. Then information from expert opinions was evaluated by designing a new questionnaire and distributing it between 3 representatives of each beneficiary group and using fuzzy theory and trapezoidal fuzzy number, and stakeholders are evaluated based on their effect rate on project costs. . The questionnaire information at this stage consists of three sections of the costs of prevention in the project, evaluation costs and failure costs. In the final stage, due to the limitation of financial resources and the inability to provide the program to meet the demands of stakeholders, the ultimate prioritization of the stakeholders will be extracted significant. Each of the stakeholders is grouped in different dimensions in order to properly understand the stakeholders. The grouping of stakeholders has taken place on the basis of domestic or external, contractual or non-negotiable, governmental or nongovernmental. The results are shown in Table 3.

Fuzzy method

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 ā= (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.



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

Figure1. Trapezoidal fuzzy number

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.

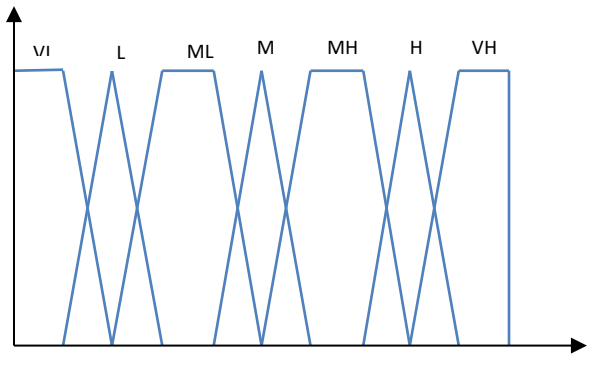
Linguistic parameters	Fuzzy number	Shape
Very low	(0,0,0.1,0.2)	
Low	(0.1,0.2,.02,0.3)	
Medium low	(0.2,0.3,0.4,0.5)	
Medium	(0.4,0.5,0.5,0.6)	
Medium high	(0.5,0.6,0.7,0.8)	
High	(0.7,0.8,0.8,0.9)	
Very high	(0.8,0.9,1,1)	

Fig 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:

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

The research done is related to road construction projects, which requires the re-evaluation of results to be used in other sectors. The final list of stakeholders has been identified as well as the evaluation indicators of each of the stakeholders and the weight of each indicator in the case study described in Tables 2, 3 and figure 3. Also, based on the analysis of the results obtained by the phase method and the quantification and normalization of information , the scope of each of the stakeholders is based on the costs of prevention, evaluation and failure are shown in Tables 4-7. The final results of stakeholder prioritization based on the total costs mentioned are shown in Fig. 4

Table 2. Final identified Stakeholder List

Stakeholder code	Stakeholder	Stakeholder category		
		G/N	C/N	I/E
S1	Employer	Governmental	Contractual	Internal
S2	Management and Planning Organization	Governmental	Non	External
S3	Opponents	Non	Contractual	Internal
S4	Investor	Non	Contractual	Internal
S5	Environmental Protection Agency	Governmental	Non	External
S6	Ministry of Energy and affiliated organizations	Governmental	Non	External
S7	Natural Resources Organization	Governmental	Non	External
S8	Supreme Council for Urbanism	Governmental	Non	External
S9	Members of Parliament	Governmental	Non	External
S10	Regulators	Governmental	Non	External
S11	Contractors	Non	Non	Internal
S12	Ministry of Economy and Finance	Governmental	Non	External
S13	Consultants	Non	Contractual	Internal
S14	Banking Institutions	Non	Non	External

S15	Municipality	Governmental	Non	External
S16	General public	Non	Non	External
S17	Traffic Organization	Governmental	Non	External
S18	Suppliers of materials	Non	Non	Internal

Table 3. Indicators for assessing the cost of stakeholder engagement on the project

Criteria	Definition	Criteria	Definition	Criteria	Definition
C1	Knowledge	C11	Project privacy (scope)	C21	Vendor Lists
C2	Skill	C12	The duration of the project	C22	Contract bureaucracy
C3	Experience	C13	Basic studies	C23	Required tests
C4	Risk-taking	C14	Design errors	C24	Standards and regulations
C5	Time constraint (hustle and compression)	C15	Design flaws	C25	Terms and Conditions
C6	Interference activities	C16	Quality of materials	C26	Negligence and carelessness
C7	Project size	C17	Equipment quality	C27	Political conditions
C8	project type	C18	Discontinued equipment	C28	Economic conditions
C9	Methods of execution	C19	Technologies used	C29	Cultural conditions
C10	Project area	C20	Financial Management and Financing Strategy	C30	natural disasters

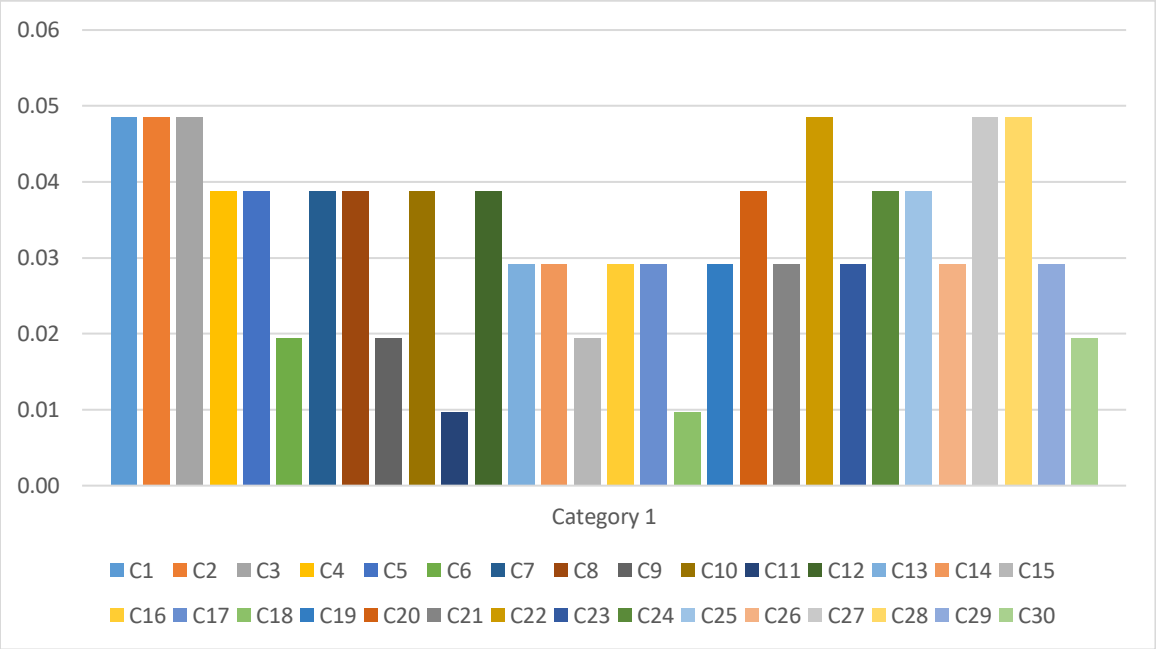


Figure 3. Weight of each assessment criterion

Table 4. Stakeholder prevention costs for each of the identified criteria

Stakeholder code	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15
S1	0.08	0.07	0.07	0.11	0.12	0.00	0.07	0.14	0.00	0.50	0.00	0.11	0.50	0.19	0.14
S2	0.07	0.05	0.07	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.06	0.09
S3	0.03	0.05	0.05	0.04	0.09	0.00	0.06	0.05	0.00	0.00	0.00	0.00	0.00	0.25	0.18
S4	0.07	0.05	0.05	0.09	0.09	0.00	0.06	0.09	0.00	0.00	0.00	0.14	0.00	0.00	0.00
S5	0.05	0.02	0.02	0.04	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S6	0.02	0.02	0.02	0.07	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S7	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S8	0.05	0.07	0.05	0.02	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S9	0.03	0.00	0.00	0.00	0.12	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S10	0.07	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.14
S11	0.08	0.12	0.12	0.11	0.12	0.00	0.07	0.18	0.00	0.00	0.00	0.14	0.00	0.13	0.23
S12	0.05	0.02	0.05	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S13	0.08	0.12	0.12	0.11	0.09	0.00	0.07	0.23	0.00	0.00	0.00	0.07	0.20	0.31	0.23
S14	0.05	0.07	0.07	0.09	0.09	0.00	0.06	0.05	0.00	0.00	0.00	0.11	0.00	0.00	0.00
S15	0.05	0.07	0.05	0.02	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S16	0.05	0.02	0.09	0.09	0.09	0.00	0.06	0.09	0.00	0.50	0.00	0.11	0.00	0.00	0.00
S17	0.07	0.10	0.09	0.07	0.09	0.00	0.06	0.09	0.00	0.00	0.00	0.11	0.30	0.00	0.00
S18	0.07	0.10	0.09	0.09	0.09	0.00	0.06	0.09	0.00	0.00	0.00	0.07	0.00	0.00	0.00
Stakeholder code	C16	C17	C18	C19	C20	C21	C22	C23	C24	C25	C26	C27	C28	C29	C30
S1	0.16	0.19	0.00	0.17	0.18	0.42	0.00	0.14	0.18	0.00	0.00	0.00	0.00	0.00	0.00
S2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.20	0.00	0.00	0.00	0.00	0.00
S3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S4	0.00	0.00	0.00	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S5	0.16	0.14	0.00	0.08	0.00	0.00	0.00	0.07	0.18	0.12	0.00	0.00	0.00	0.00	0.00
S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00
S10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00
S11	0.26	0.24	0.00	0.33	0.18	0.17	0.00	0.29	0.24	0.16	0.00	0.00	0.00	0.00	0.00
S12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S13	0.16	0.19	0.00	0.42	0.18	0.42	0.00	0.29	0.24	0.12	0.00	0.00	0.00	0.00	0.00
S14	0.00	0.00	0.00	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S18	0.26	0.24	0.00	0.00	0.11	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 5. Stakeholder evaluation costs for each of the identified criteria

Stakeholder code	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15
S1	0.28	0.25	0.24	0.36	0.24	0.00	0.28	0.45	0.22	0.25	0.00	1.00	1.00	0.50	0.50
S2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S11	0.22	0.33	0.24	0.29	0.24	0.00	0.22	0.27	0.44	0.00	0.00	0.00	0.00	0.00	0.00
S12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S13	0.28	0.42	0.29	0.36	0.29	0.00	0.28	0.27	0.33	0.42	0.00	0.00	0.00	0.50	0.50
S14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S18	0.22	0.00	0.24	0.00	0.24	0.00	0.22	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00
Stakeholder code	C16	C17	C18	C19	C20	C21	C22	C23	C24	C25	C26	C27	C28	C29	C30
S1	0.00	0.00	0.00	0.18	0.00	0.29	0.29	0.22	0.29	0.20	0.00	0.13	0.05	0.20	0.00
S2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00
S3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.05	0.00	0.00
S4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.00	0.00
S5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S11	0.00	0.00	0.00	0.24	0.00	0.24	0.14	0.28	0.29	0.30	0.00	0.38	0.23	0.10	0.00
S12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00
S13	0.00	0.00	0.00	0.29	0.00	0.18	0.57	0.22	0.29	0.30	0.00	0.38	0.18	0.40	0.00
S14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00
S15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.00
S18	0.00	0.00	0.00	0.29	0.00	0.29	0.00	0.28	0.14	0.20	0.00	0.00	0.00	0.00	0.00

Table 6. Stakeholder failure costs for each of the identified criteria

Stakeholder code	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15
S1	0.09	0.09	0.12	0.10	0.10	0.00	0.08	0.22	0.56	0.08	0.11	0.00	0.50	0.31	0.31
S2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S3	0.09	0.09	0.05	0.10	0.00	0.00	0.08	0.22	0.00	0.08	0.44	0.00	0.00	0.00	0.00
S4	0.09	0.07	0.05	0.10	0.06	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S5	0.07	0.09	0.07	0.08	0.10	0.00	0.08	0.00	0.44	0.14	0.00	0.00	0.00	0.00	0.00
S6	0.06	0.07	0.07	0.08	0.10	0.00	0.08	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00
S7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S8	0.06	0.05	0.05	0.02	0.06	0.00	0.08	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00
S9	0.04	0.05	0.05	0.08	0.10	0.00	0.08	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.00
S10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S11	0.09	0.09	0.12	0.10	0.10	0.00	0.08	0.22	0.00	0.11	0.00	0.00	0.00	0.31	0.31
S12	0.07	0.09	0.05	0.08	0.06	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S13	0.09	0.09	0.12	0.10	0.10	0.00	0.08	0.17	0.00	0.05	0.00	0.00	0.20	0.38	0.38
S14	0.09	0.09	0.09	0.10	0.06	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S16	0.07	0.05	0.12	0.10	0.08	0.00	0.08	0.00	0.00	0.08	0.44	0.00	0.00	0.00	0.00
S17	0.07	0.09	0.07	0.00	0.08	0.00	0.08	0.17	0.00	0.11	0.00	0.00	0.30	0.00	0.00
S18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Stakeholder code	C16	C17	C18	C19	C20	C21	C22	C23	C24	C25	C26	C27	C28	C29	C30
S1	0.00	0.00	0.27	0.14	0.22	0.00	0.11	0.18	0.10	0.13	0.12	0.14	0.14	0.14	0.12
S2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S3	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.12
S4	0.00	0.00	0.00	0.00	0.17	0.00	0.09	0.00	0.00	0.10	0.00	0.00	0.00	0.18	0.05
S5	0.00	0.00	0.00	0.18	0.00	0.00	0.09	0.23	0.17	0.13	0.12	0.14	0.18	0.00	0.12
S6	0.00	0.00	0.00	0.18	0.00	0.00	0.09	0.23	0.17	0.13	0.12	0.00	0.00	0.00	0.12
S7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S8	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.10	0.13	0.08	0.00	0.00	0.00	0.05
S9	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.18	0.00	0.18	0.00
S10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S11	0.00	0.00	0.33	0.18	0.22	0.00	0.11	0.18	0.17	0.13	0.20	0.14	0.18	0.18	0.12
S12	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.18	0.00	0.00
S13	0.00	0.00	0.20	0.18	0.09	0.00	0.11	0.18	0.17	0.13	0.20	0.11	0.14	0.18	0.12
S14	0.00	0.00	0.00	0.00	0.17	0.00	0.09	0.00	0.13	0.10	0.00	0.00	0.18	0.00	0.10
S15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.14	0.00	0.14	0.07
S17	0.00	0.00	0.00	0.14	0.13	0.00	0.09	0.00	0.00	0.05	0.08	0.00	0.00	0.00	0.00
S18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 7. Total imposed costs of stakeholders on the project

Stakeholder code	Prevention costs	Evaluation costs	Failure costs	Sum
S1	3.53	7.39	4.45	15.37
S2	0.90	0.14	0.00	1.04
S3	0.80	0.17	1.61	2.58
S4	0.82	0.18	1.03	2.03
S5	0.95	0.00	2.42	3.37
S6	0.19	0.00	1.59	1.78
S7	0.04	0.00	0.00	0.04
S8	0.25	0.00	0.86	1.11
S9	0.41	0.00	0.97	1.38
S10	0.54	0.00	0.00	0.54
S11	3.16	4.43	3.66	11.25
S12	0.18	0.05	0.69	0.92
S13	3.64	6.75	3.56	13.95
S14	0.77	0.14	1.28	2.19
S15	0.25	0.00	0.00	0.25
S16	1.11	0.00	1.45	2.56
S17	0.97	0.30	1.45	2.72
S18	1.48	2.46	0.00	3.94

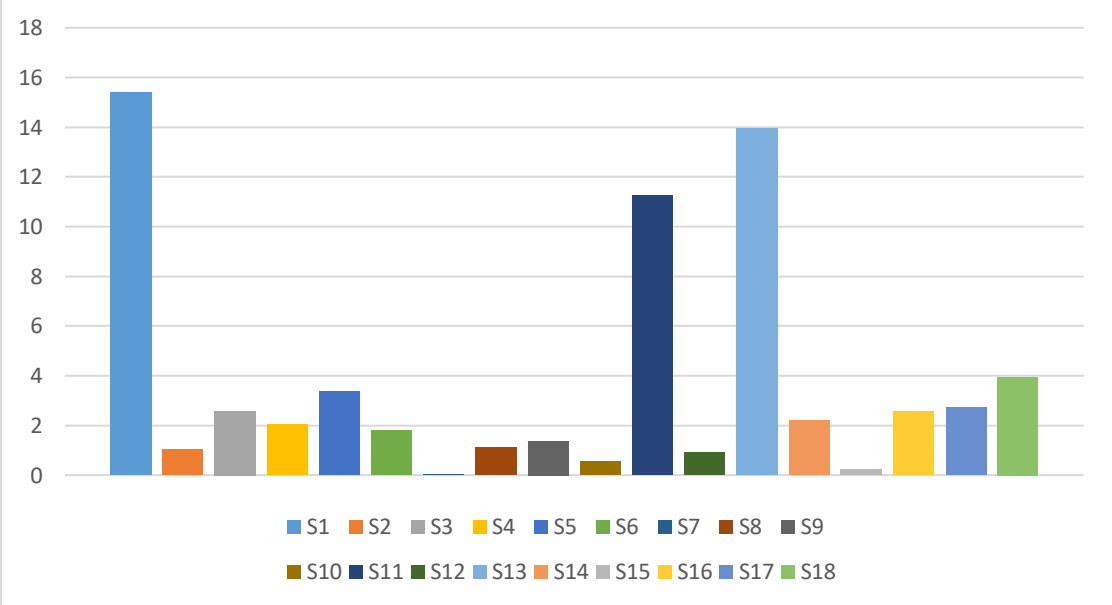


Figure 4. Stakeholders prioritization based on costs imposed on the project

DISCUSSION

As shown in Tables 4 to 6, the costs of stakeholders' actions, including prevention costs, evaluation costs, and failure costs, as outlined in the overview on the subject literature, were evaluated for the 18 final beneficiaries identified and, according to experts, among the representatives of the stakeholders; each of these costs was identified individually for each

beneficiary identified. Also, the significance of each criterion was shown in Fig. 3. Different stakeholders were prioritized on the basis of the total costs of prevention, evaluation costs and failure costs according to Tables 4-6. As stated in the results, the employer is the most influential beneficiary in project costs. This means that the employer's decisions as a key beneficiary will have a significant effect on the increase or decrease of project costs. Therefore, the employer's decisions should be managed and organized to reduce the cost of the project. The contractor was also identified as the second key beneficiary based on the amount of costs imposed on the project or project costs reduction. Therefore, it should be noted that contractor performance is managed to reduce project costs. Similarly, the following key stakeholders, including the environmental organization, suppliers of materials and project users, and all identified stakeholders were evaluated. But due to the limitations on financial resources of project for managing stakeholders, the performance of all stakeholders cannot be analyzed and presented solution to them. Therefore, among identified key stakeholders, S1, S11, S13, S18, S5, S17, and S16 and S3, according to the evaluation and disagreement with other stakeholders, were considered as the most important stakeholders in the project, the project is based on the impact on project costs, which should be programmed to manage and organize their performance.

CONCLUSION

Identifying and evaluating project stakeholders are one of the most important steps in stakeholder management as one of the areas of project management. In the present study, according to the studies, as indicated in the results employer, contractor, consultant, materials suppliers, environmental organization, traffic organization, and users as the most important stakeholders of road construction projects were identified based on the amount of effect on project costs. But the limitations in the projects make it impossible to answer all the demands of all key stakeholders, So, in the case of financial constraints, the prioritization of each stakeholder should be determined by other stakeholders, based on existing program constraints. In the present study, the most important stakeholders of the studied projects were identified employer, contractor, consultant, material suppliers, and environmental organization. In subsequent researches, writers can focus on identifying and prioritizing key stakeholders' expectations. Also, prioritizing the stakeholders of road construction projects with other existing prioritization methods can also be the subject of research by researchers in future studies. It is also suggested that in separate research, identify the risks that the stakeholders impose on construction projects and, based on the amount of costs and risks imposed on the projects, a basket of stakeholders is to be extracted to answer key stakeholders. The present research is aimed at identifying the costs imposed by stakeholders on construction projects after key stakeholders review and identifying the criteria and costs of the various sectors that can be used.

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