The efficiency of cost-reimbursable contracts in government projects

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Abstract

This study aimed to evaluate the relationship between the identification and impact of influential factors on the efficiency of cost-reimbursable contracts in government projects for eliminating and reducing problems. Delayed exploitation of projects causes them to lose their technical and economic justification while wasting national capital. When unstable conditions and inflation dominate the economy, contractors do not accept plans due to reduced profit and abandon projects. The mentioned cases increase the number of construction plans and projects in the form of escrow contracts, indicating the efficiency of escrow contracts in government projects. Therefore, these cases should be examined to determine the advantages and disadvantages and provide solutions to solve and reduce the problems. Thus, a field study was conducted to identify the influential factors in cost-reimbursable contracts of construction projects. This survey correlation study surveyed various sources and research to determine the significant factors through a questionnaire. The research population comprises 150 people, 108 selected using Cochran's sampling method. The data were collected by field research using closed questionnaires with Likert and five-option Likert scales. A questionnaire with 28 questions was designed for the research variables in total. The questionnaire's validity and reliability were distributed among several consultants, contractors, and municipal employees, and information was collected. Then the research hypotheses were tested by data analysis at two descriptive and inferential statistics levels and using SPSS software and Pearson's correlation coefficient test. The results indicated a positive and significant relationship between the factors related to the contractor's employer, design, labor, materials required for construction, external intervening factors, the nature of the project, design/equipment, and delay in cost-reimbursable contracts of government projects.

Keywords: Cost-reimbursable contract, Government projects, Employer, Questionnaire, SPSS software
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1 Introduction

As one of the most important legal acts, the contract has taken a significant part of the legal regulations. There are differences in the definition of contract and its relationship with similar titles such as transaction and contract. A contract can be defined as an agreement and cooperation of the parties' wills to create a legal nature. The contract can have various effects such as transfer of ownership, creation of obligation, new legal personality, the transformation

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of obligation, and deterioration of existing rights relationship [5]. This issue is under the principle of sovereignty of the will, whose primary manifestation is contractual freedom. According to this principle, people can conclude any contract they want within limiting factors such as good morals and public order [4].

The contract was classically conceived as an act between equals. For this reason, many of the rules and principles governing the law of contracts refer to the regulation of relations between persons who are close to each other in terms of equality [11]. The classical principles of contract law, especially in the jurisprudence system, were set in a period in which the government and other public institutions were not present in the social life of humans. With the emergence of the government as a legal entity, the necessity of performing general duties and providing public services at a comprehensive military level became the rule over contracts, one party of which is the government or other similar institutions. Generally, government contracts are divided into administrative and non-administrative categories [2]. An administrative contract is a contract that is subject to the public law system both in terms of the formalities of conclusion and in terms of the governing ruling. Administrative bodies must follow the rules and regulations of public law to conclude their contracts, such as the contracts by which mineral extraction concessions are given to individuals. On the other hand, a non-administrative contract is a contract subject to the provisions of public law and mandatory rules in terms of concluding formalities, which is subject to the provisions of civil and commercial private law [12].

Contracts explain the procedures, communications, powers, and obligations of the parties to the contract, which are identified in the construction projects of the parties to the contract with the names of the employer and the contractor and the mentioned procedures. Essential preparation of the contract is one of the most critical factors for the success of projects. The conclusion of a vague, non-comprehensive contract, coupled with unreasonable risk for the parties to the contract, will bring problems [9]. Managing and preventing disputes is much simpler and less costly than resolving disputes. Therefore, choosing the type of contract to reduce the differences between the parties is one of the essential factors before starting cooperation [7].

In the cost-reimbursable contract (single-factor) method, the employer provides all the project services, including information gathering, design, procurement of machinery, equipment and construction materials, construction, and project management within its collection to provide financial resources for the project. The essential issue is that the employer makes expenses and purchases directly and the employer guides the employees. This method is suitable when the work scope is small, its specifications are simple, and its nature is smooth [1]. The basic principle is that the employer has a trained and skilled executive force in his organization for construction works, and as a result, he chooses this method to employ and use them [3].

Therefore, this study aimed to examine the method of cost-reimbursable contracts in government projects and design a questionnaire for this area. The results were categorized and weighed in SPSS software.

2 Method

This descriptive-analytical study was conducted using library studies and preparing the reports of consulting engineers to summarize the necessary information. An interview was conducted as an open question and answered with 108 experts in civil engineering, urban architecture, and urban planning in the building engineering system organization of East Azarbaijan province, Tabriz municipality, and the General Directorate of Roads and Urban Development of Tabriz. The participants had a minimum of 31 and a maximum of 53 years of age. Questionnaire questions were asked based on interviews with ten provincial experts and library studies. The Likert rating scale was also used to complete the questionnaire. Table 1 shows the method of valuing on the Likert scale is presented.

Table 1: How to value on the Likert scale [8].

Proposition	**Effect on the target**	Score
I completely disagree	very little	1
I disagree	Low	2
No idea	medium	3
I agree	Much	4
I quite agree	very much	5

2.1 Sampling

Sampling is the process of selecting a limited number of members of the society so that the researcher can generalize the characteristics of the society by examining the sample and understanding the characteristics of the sample subjects.

A sample is a group of members of a defined society, with the help of which information needed for research is obtained [8]. The sample size of this study is calculated using Cochran's formula.

$$n = \frac{\frac{z^2 pq}{d^2}}{1 + \frac{1}{N}(\frac{z^2 pq}{d^2} - 1)} \tag{1}$$

n: statistical sample size

N: the size of the statistical population

d: permissible error (usually considered 0.05)

Z: the value of the normal variable with confidence level $\alpha - 1$. In the two-domain test, the z value for the 95% confidence level is 1.96, and the 99% confidence level is 2.58.

p: Proportion of possessing the desired attribute (for example, male population)

$q = (p-1)$: Proportion of not having the desired attribute (for example, female population). p and q are considered 0.5.

According to the sources, this calculation is done with an error level of 5%. According to the formula, the sample volume is equal to 108 people.

2.2 Data collection

The library method (observation and study of library resources, magazines, publications, and the Internet) was used to collect information about the subject literature and the background of the research. There are many tools to collect information, including observation, interviews, and questionnaires. This research used a field method and questionnaire tool to collect research data. In this article, a researcher-made questionnaire was used and distributed among the people of the statistical society. A questionnaire with a 5-point Likert scale was used.

2.3 Questionnaire

The questionnaire is a way to obtain specific information about a particular problem so that after analysis and interpretation, this information causes a better evaluation of the problem [8]. Danaei Fard et al. [6] considered the questionnaire a pre-compiled set in which the respondents choose their answers within a range of specific options. A questionnaire was used to collect the desired information to test the hypotheses. The theoretical foundations of this field as well as the opinions of supervisors, consultants, and officials in the field of urban project management, were used to prepare the questions of the questionnaire. The questionnaire consisted of two sections: general questions and specialized questions.

General questions contain four questions that question the demographic characteristics of contractors and municipal employees. Specialized questions include the central part of the questionnaire and evaluate the opinions of the question.

The Likert scale is an interval scale consisting of several terms and options [13]. This spectrum helps the respondents to express their attitudes and belief by selecting the relevant phrase; in this way, the researcher can determine the respondent's attitude. Table 2 shows an example of the Likert scale used in the questionnaire.

Table 2: Likert scale.

Selective option	I completely disagree	Disagree	Somewhat	Agree	I completely agree
Score	1	2	3	4	5

2.4 Questionnaire components

This research questionnaire includes two sections of general and specialized questions, as seen in Table 3.

Table 3: Likert scale.

Variable	Number of questionnaires
Employer	1-5
Designing	6-9
Human resource	10-13
Required materials	14-17
Intervening external factors	18-21
project nature	22-25
Equipment	26-28

2.5 Reliability

The data accuracy is not reliable without knowing the validity of the measurement. A measurement tool may be valid for measuring a special characteristic, while it is not valid for measuring the same characteristic in another society [10]. There are different ways to measure the reliability of a questionnaire, including face validity and empirical validity, and face validity was used in this research. The meaning of formal validity is to identify the validity of indicators or indicators of research through reference to judges and technical experts. The criteria used in this study to ensure the face validity of the measuring instrument are using previously tested questionnaires in similar studies and seeking opinions from supervisors and advisors.

2.6 Reliability of the measurement tool

Reliability is one of the characteristics of measuring instruments, which deals with how much the measurement tool gives the same results under the same conditions. In other words, a valid instrument has repeatability characteristics and can be used in many cases, and the same results can be obtained in all cases [18]. Researchers who use SPSS software use Cronbach's alpha coefficient method to determine the reliability of their research. Cronbach's alpha coefficient is a reliability coefficient that shows how the items in a set are appropriately tied to each other. First, the variance of the scores of each subset of the questionnaire questions and the total variance should be calculated to calculate Cronbach's alpha coefficient. Then, Equation 2 is used to calculate the value:

$$\alpha = \left(\frac{n}{n-1}\right) \times \left(1 - \frac{\sum s_i^2}{s_t^2}\right) \tag{2}$$

In which, n is the number of test questions, S_i^2 shows the variance of question i, S_t^2 donates the variance of the whole test. The closer this value is to 1, the greater the internal consistency reliability [8]. Since the reliability of each

Table 4: Questionnaire reliability by each variable

Reliability	Cronbach's alpha
Employer	0.856
Designing	0.903
Human resource	0.867
Required materials	0.936
Intervening external factors	0.875
The nature of the project	0.814
Equipment	0.891

variable as well as the reliability of the whole questionnaire, is higher than 0.7 (the minimum allowed value), the questionnaire of this research has sufficient reliability.

3 Results

Data analysis is a multi-step process during which the data is obtained through collection tools in the statistical sample. The data are summarized, coded, categorized, and finally processed to provide the basis for various analyses and connections between these data to test the hypotheses. Data analysis includes three primary operations: first, description and preparation of data necessary to test hypotheses, then analysis of relationships between variables, and finally, comparison of the observed results with the results expected by the hypotheses. Data are refined conceptually and empirically in this process, and various statistical techniques play a significant role in inferences and generalizations.

3.1   Data analysis

Descriptive statistics techniques such as frequency tables and pie charts were used to identify and explain the demographic characteristics of the respondents for the statistical description of demographic data. In addition, statistical techniques available in SPSS, including the Kolmogorov-Smirnov test (KS test), Pearson test, and regression, were used to test research hypotheses.

3.2 Descriptive analyses

The first question that comes to the mind of every researcher is whether it is possible to describe this large set of values and how to organize the many observations of society in a specific framework. In the descriptive analysis, the researcher analyzed the demographic data collected from the statistical sample using appropriate descriptive analysis tools, including frequency tables and pie charts. The results of the study are as follows.

3.3 Normality of the data

A number of data (numbers) are always available after any type of measurement, which must be discovered or categorized to be able to analyze. Therefore, it is necessary to determine the data distribution. In simpler terms, data distribution specifies the spread of the collected data. The normal distribution is also one of these patterns, and the non-normality of the data distribution indicates that the correlation coefficient of the data is greatly reduced and indicates the absence of a linear relationship between the variables. Therefore, the data distribution's normality indicates the data's convergence and a kind of correlation between the data of our research. The normality of the data should be tested first to determine which category of statistical tests can be used in SPSS. For this purpose, the hypothesis related to this part are:

H_0 =The data distribution is normal—-$sig \geq 0.05$

H_0 =The data distribution is not normal—-$sig < 0.05$

The above hypothesis was checked for the research variables through the Kolmogorov-Smirnov test (KS test) (Table 5).

Table 5: Normality test of research variables

Component	Sig	Result
Employer	0.31	Normal
Designing	0.07	Normal
Human resource	0.21	Normal
Required materials	0.059	Normal
Intervening external factors	0.29	Normal
The nature of the project	0.27	Normal
Equipment	0.12	Normal

Table 5 shows that the calculated error in all variables is more than 0.05.

4 The first hypothesis

There is a positive and significant relationship between factors related to the employer (the project owner) and the efficiency of cost-reimbursable contracts in government projects. The results of the Kolmogorov-Smirnov test indicated that the research variables were normal, and the Pearson test was used.

According to Tables 4 and 5, the relationship between the various factors related to the employer (the project owner) and the efficiency of the cost-reimbursable contract in government projects with a correlation coefficient of 0.45, the calculated error rate (Sig) is 0.000 less than the standard error rate (0.05). In other words, 59.4 percent of changes in the dependent variable of cost-reimbursable contracts in government projects are explained by the variable of factors related to the employer. In addition, the significant level is less than 0.5%. At the 99% confidence level, a significant positive relationship exists between employer-related factors and cost-reimbursable contracts in government projects. Therefore, the above hypothesis is confirmed.

Table 6: Pearson's correlation coefficient test of factors related to the employer (the project owner) and the efficiency of cost-reimbursable contracts in government projects

		The effectiveness of cost-reimbursable contracts in government projects
Factors related to the employer (the project owner)	Pearson correlation co-efficient	0.450
	Significant level	0.000
	Number	108

Table 7: Regression of factors related to the employer (the project owner) and the efficiency of cost-reimbursable contracts in government projects

Variables	Model	Std.Error	Beta	Sum of square	Df	F	Sig.
Factors related to the employer (the project owner) and cost-reimbursable contract in government projects	regression	0.057	0.594	609.581	1	68.485	0.000

4.1 The second hypothesis

There is a positive and significant relationship between the factors related to the design and efficiency of cost-reimbursable contracts in government projects. Since the results of the Kolmogorov-Smirnov test indicate that the research variables are normal, the Pearson test was used.

Table 8: Pearson correlation coefficient test of factors related to the design and efficiency of cost-reimbursable contracts in cost-reimbursable projects

		The effectiveness of cost-reimbursable contracts in government projects
Factors related to the design	Pearson correlation co-efficient	0.538
	Significant level	0.000
	Number	108

Table 9: Regression of factors related to the contractor and the efficiency of cost-reimbursable contracts in government projects

Variables	Model	Std.Error	Beta	Sum of square	Df	F	Sig.
Factors related to the design and cost-reimbursable contract in government projects	regression	0.042	0.444	870.459	1	109.70	0.000

The correlation coefficient between the variable of factors related to the design and efficiency of cost-reimbursable contracts in government projects, the relationship between these variables is 0.538, and the calculated error (Sig) is 0.000 less than the standard error (0.05) (Beta=0.444). Therefore, 44.4% of the changes in the dependent variable of cost-reimbursable contracts in government projects are explained by the variables of factors related to design. There is a significant positive relationship between design-related factors and cost-reimbursable contracts in government projects, and the above hypothesis is confirmed.

4.2 The third hypothesis

There is a positive and significant relationship between the factors related to the labor force and the efficiency of cost-reimbursable contracts in government projects. Since the results of the Kolmogorov-Smirnov test indicate that the research variables are normal, the Pearson test was used.

The correlation coefficient between the variable between the factors related to the labor force and the efficiency of cost-reimbursable contracts in government projects, the relationship between these variables was 0.605, and the calculated error rate (Sig) is 0.000 less than the standard error rate (0.05) (Beta=0.473). About 47.3% of the changes in the dependent variable of cost-reimbursable contracts in government projects were explained by the variable of

Table 10: Pearson's correlation coefficient test of factors related to the labor force and cost-reimbursable contracts in government projects

		The effectiveness of cost-reimbursable contracts in government projects
Factors related to labor force	Pearson correlation co-efficient	0.605
	Significant level	0.000
	Number	108

Table 11: Regression of factors related to the labor force and efficiency of cost-reimbursable contracts in government projects

Variables	Model	Std.Error	Beta	Sum of square	Df	F	Sig.
Factors related to the labor force and cost-reimbursable contract in government projects	regression	0.0308	0.473	988.937	1	155.821	0.000

labor-related factors. There is a significant positive relationship between the factors related to the labor force and cost-reimbursable contracts in government projects, and the above hypothesis is confirmed.

5 The fourth hypothesis

There is a positive and significant relationship between the factors related to the materials required for the project's construction and the efficiency of cost-reimbursable contracts in government projects. The results of the Kolmogorov-Smirnov test indicated that the research variables are normal, and Pearson's test was used.

Table 12: Pearson's correlation coefficient test of the factors related to the materials required for the construction of the project and the effectiveness of cost-reimbursable contracts in government projects

		The effectiveness of cost-reimbursable contracts in government projects
Factors related to materials required	Pearson correlation co-efficient	0.665
	Significant level	0.000
	Number	108

Table 13: Regression of factors related to materials required for project construction and cost-reimbursable contract efficiency in government projects

Variables	Model	Std.Error	Beta	Sum of square	Df	F	Sig.
Factors related to the materials required and cost-reimbursable contract in government projects	regression	0.061	0.889	1956.229	1	214.12	0.000

The correlation coefficient between the variable of the factors related to the materials required for the project's construction and the efficiency of cost-reimbursable contracts in government projects, the relationship between these variables was 0.665. The calculated error rate (Sig) is 0.000 less than the standard error rate (0.05), and the beta equals 0.889. In other words, 88.9% of changes in the dependent variable of cost-reimbursable contracts in government projects are explained by the variable of factors related to the consultant. The significance level of less than 0.5% shows a significant positive relationship at the 99% confidence level between the factors related to the materials required for the project's construction and cost-reimbursable contracts in government projects. Therefore, the above hypothesis is confirmed.

6 Conclusion

The second hypothesis examined the relationship between factors related to design and cost-reimbursable contracts in government projects. In this contracting method, advanced and accurate software is not usually used for design,

construction, and project management. Therefore, there would be a dispute between the employer and the members involved in the project, causing the delay. The third hypothesis investigated the factors related to the labor force and cost-reimbursable contracts in government projects. The variable "labor-related factors" significantly affected the delay in cost-reimbursable contracts in government projects. The respondents thought that the project manager's correct performance and appropriate and timely decision-making in preventive measures and providing the appropriate policy to the engineering, project control, and executive departments directly impact project delays. Based on the third hypothesis regarding the relationship between labor and trust contracts in government projects and according to the respondents, it can be concluded that in this method, the labor force of the executive group was insufficient. This causes disturbances in the progress of projects, especially relatively large projects in government projects. In this contractual system, the employer (project owner) benefits from eliminating the costs of following the conventional methods of concluding the contract. In addition, time is saved by eliminating the process of selecting contractors through tenders and other cases. In this section, 13 to 15% of the profit the subcontractors should earn is removed. Contrary to expectations, the finished price of these projects is generally similar to other modes. In addition, the work speed decreases, and there needs to be an assurance of better quality in different project stages. It should be noted that this type of contractual system is appropriate for implementing projects with low scope and low technical complexity.

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