



## Original Article



# Factors Affecting the Success of Outsourcing IT Projects of Ahvaz Water and Wastewater Company by the Best-Worst Method

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Email: [nazari\\_lib@yahoo.com](mailto:nazari_lib@yahoo.com)**Abstract**

**Background:** Outsourcing is one of the possible solutions in which an organization decides to separate the information technology (IT) related tasks and provide them to another organization for supply. The purpose of this study is to identify and ranking the factors affecting the success of outsourcing IT projects of Ahvaz Water and Wastewater Company by the best-worst method. The design of the study is exploratory and survey type.

**Methods:** The population of this research consists of the director of the Information Technology and e-Government Development Office with 1 person and the information technology staff with 14 people of Ahvaz Water and Sewerage Company. Due to the small size of the population, no sampling was done and all members were surveyed through a census. Data collection tool was a questionnaire and Delphi method and best-worst methods were used to analyze the data. Based on the findings of the Delphi method, 7 factors (strategic importance of the project, project characteristics, contractor characteristics, technology characteristics, company characteristics, information technology costs and the quality of relationship with the contractor) and 26 sub-factors were identified.

**Results:** The strategic importance of the project with a weight of 0.2868 is the most important factor and the quality of the relationship with the contractor with a weight of 0.05 is the least important factor.

**Conclusion:** THE findings of this study can be used for other institutions and public organizations and to play the role of a conductor for future researches in other institutions or organizations.

**Keywords:** Outsourcing, IT projects, Best-Worst method, Ahvaz Water and Sewerage Company

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**Introduction**

Ahvaz Water and Wastewater Company is determined to implement and institutionalize an integrated management system including a quality management system based on the ISO14001:2015-Environmental management systems, in line with two customer-oriented strategies and compliance with the requirements of external stakeholders, and with an emphasis on knowledge, commitment and human capital participation. The organizational policy to achieve this goal is: receiving, investigating and researching the current and future needs of organizational beneficiaries, improving customer satisfaction, identifying, evaluating and effectively controlling environmental aspects and complying with related legal requirements Improving personnel safety and occupational health.

Today, information technology has become an essential part of the success of any company in the globalized age,

and companies' dependence on information technology for support, survival and growth is increasing.<sup>1</sup> Information technology (IT), as an umbrella term, encompasses all devices and applications such as cell phones, personal computers, and social media applications that enable people to interact with each other in the digital world.<sup>2</sup>

Today, in the age of globalization and the increasing demand for business competition, companies need to strive to improve the performance of their business through effective and efficient management of the organization. One of the made efforts is to hire a minimum number of workers in order to be able to provide the maximum share according to the company's goals. For this reason, companies seek to focus on what is their core business, while leaving the support of other tasks to other people. This process is known as *outsourcing*.<sup>3</sup> Outsourcing IT processes is a common business practice in contemporary



businesses.<sup>4</sup> The term “outsourcing” is derived from the phrase *providing external resources* and describes the way organizations use resources beyond the borders. Companies that take this approach hire a foreign company to do some or all of the company’s logistics activities.<sup>5</sup> Outsourcing involves contracting out specific functions or tasks of public services to private companies, including for-profit and third sector (non-profit) organisations.<sup>6</sup> Outsourcing can be defined as the transfer of business activities, operations and processes to a foreign company that was previously done internally.<sup>7</sup> To maintain a competitive advantage, companies need to reduce operating costs and increase the focus on core competencies and management flexibility through a better use of internal resources. Outsourcing of non-core activities increases the response to customer needs and reduces financial and operational risks by reducing investments.<sup>8</sup> Many companies use IT outsourcing to maximize benefits and minimize costs.<sup>9</sup> If the IT outsourcing process is managed properly, it will bring many benefits to the company. The important issues in IT outsourcing are what needs to be considered in outsourcing success, and what factors affect the success of IT outsourcing. Previous research has shown that various factors affect the success of outsourcing IT projects.

Technology dimension is the most effective dimension and strategy dimension is the most affective dimension among the studied dimensions of outsourcing evaluation of information technology projects.<sup>10</sup> Akbar et al believed that the rate of technology change, the complexity of the required technology and the novelty or maturity of technology.<sup>11</sup> According to Rahman et al, the IT staff’s areas of expertise and providing employee benefits are the characteristics of the company and technology.<sup>12</sup> Atkinson et al presented 58 criteria for IT outsourcing decision making.<sup>13</sup> Karimi-Alagheband and Rivard believed successful reconfiguration of dynamic capabilities is effective in IT outsourcing success. Also, the results showed that successful delivery plays a mediating role in the effect of dynamic capabilities on the success of IT outsourcing.<sup>14</sup> As a result, the issue of using external resources to use information technology in the company is one of the key issues and important topics. Accordingly, managers are faced with important issues, for example, which factors affect the success of outsourcing IT projects. Therefore, although the issue of outsourcing IT projects may seem simple, doing it without any awareness will be very harmful for the company. Olstad et al note that outsourcing occurs when one company contracts with another company to provide services or products.<sup>15</sup> Prawesh et al highlighted that outsourcing has now become an integral part of a company’s IT investment strategy. On average, American companies spend 14% of their IT budget on IT outsourcing activities.<sup>16</sup> According to the issues mentioned above, outsourcing in the field of information technology projects in Ahvaz Water and Sewerage Company is not considered as an option, it is a strategic necessity so that Ahvaz Water and Sewerage

Company can focus on its main tasks and by reducing operating costs and technology risk, use external resources to achieve organizational goals and provide optimal service to customers. Therefore, this study intends to use the best-worst method to identify and rank the factors affecting the outsourcing success of information technology projects in Ahvaz Water and Sewerage Company. Therefore, according to the above mentioned, this study is designed to answer the following questions: What are the factors affecting the success of outsourcing IT projects in Ahvaz Water and Sewerage Company? How are they ranked?

### Materials and Methods

Based on purpose, this research is applied. In terms of nature and survey, it is exploratory. The statistical population in this study is 1 person at the director of the Information Technology and e-Government Development Office and 14 IT staff (software, hardware and network) of Ahvaz Water and Sewerage Company and all members were polled through a census. In the present study, after reviewing and compiling the research questions and objectives, the Literature review and library studies were reviewed to identify the factors affecting the outsourcing success of information technology projects.

The best-worst method is the latest decision-making method. It is multi-criteria which has less comparison and higher reliability than other multi-criteria decision making methods.

Compared with the Analytic Hierarchy Process (AHP), it involves fewer comparisons and produces more consistent comparisons, delivering more precise outcomes. Then, through the Delphi technique (questionnaire), these factors were examined by the statistical population, the confirmed factors were ranked by the best-worst method and their weights and importance were determined. The conducting steps of this study are shown in [Figure 1](#).

For analyzing data, this research used Delphi technique, SPSS software (to identify the factors), the best-worst method and LINGO software (to rank the factors).

### Extraction of Factors Affecting the Success of Outsourcing IT Projects From Research Literature

In recent years, the development of the use of IT has been considered as one of the important competitive factors for organizations. In order to carry out their IT projects, organizations seek to use the best internal and external resources to make the most profit through the use of IT. For this reason, the issue of using external resources to use IT in the organization is one of the key issues and important topics. Accordingly, managers are faced with important issues. For example, this issue will be very important to managers that which IT activities should be outsourced. Domestic and foreign studies have pointed to many factors regarding the success of IT outsourcing projects. Based on the summary, some of the involved factors were extracted from the researches as [Table 1](#).

In this research, using Cronbach’s alpha of the factor

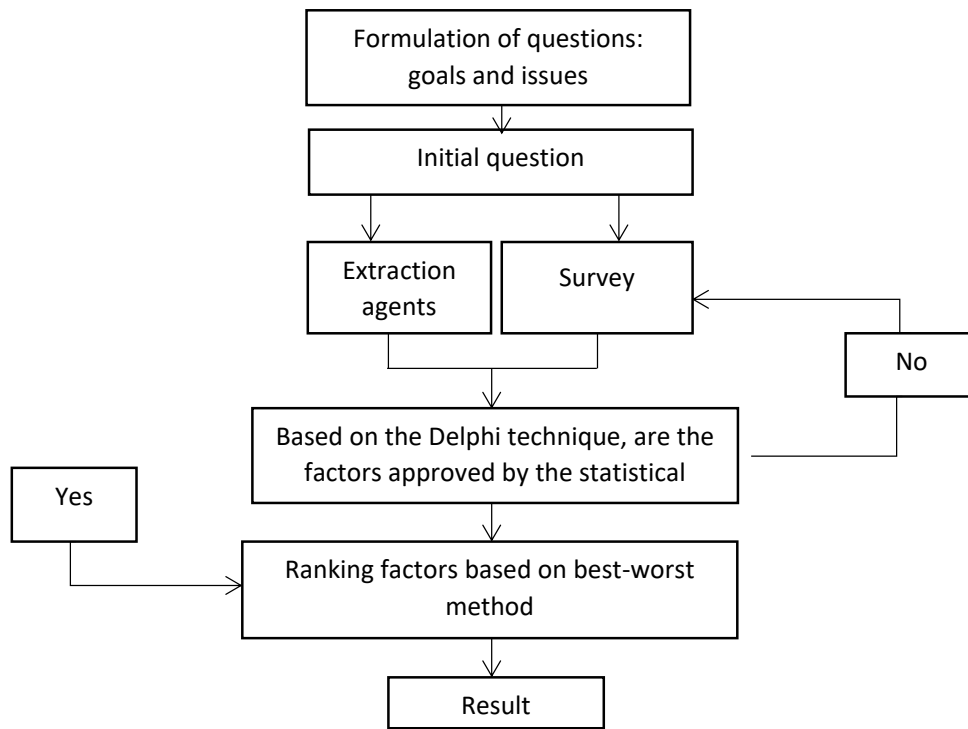


Figure 1. Research stages

Table 1. Extraction of Main and Secondary Factors From Research Literature

Factor	Sub-factor	Research
The strategic importance of the project	Project contributions in achieving the main goals of the company	17
	The extent to which the project uses the company's strategic resources	
	The confidentiality of project information	
	The importance of the project for the future of the company	
	Save time	
Project characteristics	Degree specialization of project	18
	project complexity	
	Project size	
Characteristics of the contractor	Contractor reliability	13
	Contractor's technological capability	
	Contractor's organizational capabilities	
	Contractor flexibility	
	Number of contractors	
Technology characteristics	Dependence on the contractor	11
	Technology change rate	
	Complexity of required technology	
Company characteristics	Novelty or maturity of technology	12
	IT staff's areas of Expertise	
	Financial ability and facilities of the company	
	management support	
IT costs	Providing employee benefits	11,12
	Cost of technology infrastructure	
	Operating costs within the organization	
Contractor Relationship Quality	Exchange fees	12,13,17
	How to communicate with the contractor	
	Timely sharing of information	
	No conflict between expectations and achievements	

determination questionnaire in the first and second stages was obtained as 0.856 and 0.873, respectively. According to the obtained value, the questionnaire has good reliability.

**Results and Discussion**

**Identification of Factors by Delphi Method**

In the first round of Delphi, the opinions of 15 people in the statistical population were collected in the form of a 27-item questionnaire on a 9-point Likert scale based on the evaluation of the importance of factors and by entering data in SPSS software and analyzing them by calculating a one-sample t-test, finally, 7 main factors and 26 sub-factors were identified as important factors. The results of the 27-item questionnaire and its one-sample t-test are shown in Table 2.

At this Delphi stage, the opinions of 15 people in the statistical population were obtained in the form of a 26-item questionnaire on 9-point Likert scale and analyzed by SPSS software and calculation of one-sample t-test and finally, all 26 factors were identified as having a mean score of 5 or higher. The results of one-sample t-test and a 26-item questionnaire are shown in Table 3.

**Ranking Factors on the Best-Worst Method**

Parallel comparisons of each main factor are presented in Tables 4 and 5 according to the best -worst factors. In the next step, priority vector is determined as the most important factor. To determine this vector, the statistical community was asked to determine the preference of the best-worst factor from 1 to 9; finally, the average of the collected data was obtained and reached the results of Tables 4 and 5.

Then, the weight of the factors is calculated using the following optimization model. This model is implemented in Lingo software.

$$Min \ \epsilon$$

s.t.

$$\left| \frac{w_1}{w_2} - 2.95 \right| \leq \epsilon \quad \left| \frac{w_1}{w_3} - 2.49 \right| \leq \epsilon \quad \left| \frac{w_1}{w_4} - 4.25 \right| \leq \epsilon \quad \left| \frac{w_1}{w_5} - 1.82 \right| \leq \epsilon$$

$$\left| \frac{w_1}{w_6} - 3.62 \right| \leq \epsilon \quad \left| \frac{w_1}{w_7} - 5.16 \right| \leq \epsilon \quad \left| \frac{w_2}{w_7} - 2.93 \right| \leq \epsilon \quad \left| \frac{w_3}{w_7} - 3.56 \right| \leq \epsilon$$

$$\left| \frac{w_4}{w_7} - 1.78 \right| \leq \epsilon \quad \left| \frac{w_5}{w_7} - 4.45 \right| \leq \epsilon \quad \left| \frac{w_6}{w_7} - 2.44 \right| \leq \epsilon$$

**Table 2.** Results of One-Sample T Test Related to the First Questionnaire of Factors

Factor	Sub-factor	Mean	Standard Deviation	t	P Value	Result
The strategic importance of the project	Project contributions in achieving the main goals of the company	7.13	1.12	7.34	0.000	Important
	The extent to which the project uses the company's strategic resources	7.07	1.22	6.54	0.000	Important
	The confidentiality of project information	6.93	1.10	6.80	0.000	Important
	The importance of the project for the future of the company	6.73	0.96	6.98	0.000	Important
Project characteristics	Save time	6.67	1.29	5	0.000	Important
	Degree specialization of project	7	1.06	7.24	0.000	Important
	Project complexity	6.53	1.06	5.60	0.000	Important
Characteristics of the contractor	Project size	6.73	1.43	4.67	0.000	Important
	Contractor reliability	7.13	1.06	7.79	0.000	Important
	Contractor's technological capability	6.93	1.16	6.43	0.000	Important
	Contractor's organizational capabilities	6.40	1.05	5.13	0.000	Important
	Contractor flexibility	6.67	1.11	5.80	0.000	Important
	Number of contractors	4.93	0.96	0.26	0.792	Important
Technology characteristics	Dependence on the contractor	6.67	1.11	5.80	0.000	Important
	Technology change rate	6.53	1.30	4.56	0.000	Important
	The complexity of required technology	7	1.19	6.48	0.000	Important
Company characteristics	Novelty or maturity of technology	6.73	1.16	5.77	0.000	Important
	IT staff's areas of Expertise	6.87	1.18	6.08	0.000	Important
	Financial ability and facilities of the company	7.07	1.16	6.88	0.000	Important
	management support	6.80	1.01	6.87	0.000	Important
IT costs	Providing employee benefits	6.53	0.99	5.99	0.000	Important
	Cost of technology infrastructure	6.87	1.30	5.55	0.000	Important
	Operating costs within the organization	7.07	1.03	7.75	0.000	Important
Contractor Relationship Quality	Exchange fees	6.67	1.11	5.80	0.000	Important
	How to communicate with the contractor	6.93	0.96	7.79	0.000	Important
	Timely sharing of information	6.80	1.26	5.51	0.000	Important
	No conflict between expectations and achievements	6.60	0.91	6.80	0.000	Important

**Table 3.** Results of One-Sample T-Test Related to the Second Factor Identification Questionnaire

Factor	Sub-factor	Mean	Standard Deviation	t	P Value	Result
The strategic importance of the project	Project contributions in achieving the main goals of the company	7.33	0.81	11.06	0.000	Important
	The extent to which the project uses the company's strategic resources	7.27	0.96	9.13	0.000	Important
	The confidentiality of project information	7.13	0.83	9.90	0.000	Important
	The importance of the project for the future of the company	6.93	0.70	10.64	0.000	Important
Project characteristics	Save time	6.87	1.12	6.42	0.000	Important
	Degree specialization of project	7.20	0.77	11	0.000	Important
	Project complexity	6.73	0.88	7.59	0.000	Important
Characteristics of the contractor	Project size	6.93	1.28	5.85	0.000	Important
	Contractor reliability	7.33	0.72	12.48	0.000	Important
	Contractor's technological capability	7.13	0.91	9.02	0.000	Important
	Contractor's organizational capabilities	6.60	0.910	6.80	0.000	Important
	Contractor flexibility	6.87	0.915	7.89	0.000	Important
Technology characteristics	Dependence on the contractor	6.87	0.915	7.89	0.000	Important
	Technology change rate	6.73	1.16	5.77	0.000	Important
	The complexity of required technology	7.20	0.94	9.05	0.000	Important
Company characteristics	Novelty or maturity of technology	6.93	0.96	7.79	0.000	Important
	IT staff's areas of Expertise	7.07	0.96	8.32	0.000	Important
	Financial ability and facilities of the company	7.27	0.88	9.93	0.000	Important
	Management support	7	0.75	10.24	0.000	Important
IT costs	Providing employee benefits	6.73	0.79	8.10	0.000	Important
	Cost of technology infrastructure	7.07	1.10	7.27	0.000	Important
	Operating costs within the organization	7.27	0.70	12.47	0.000	Important
Contractor Relationship Quality	Exchange fees	6.87	0.91	7.89	0.000	Important
	How to communicate with the contractor	7.13	0.64	12.91	0.000	Important
	Timely sharing of information	7	1.06	7.24	0.000	Important
	No conflict between expectations and achievements	6.80	0.67	10.31	0.000	Important

**Table 4.** Priority of the most important factor over other factors

The Most Important Factor	The Strategic Importance of the Project	Project Characteristics	Characteristics of the Contractor	Technology Characteristics	Company's Characteristics	IT Costs	Contractor Relationship Quality
The strategic importance of the project	1	2.95	2.49	4.25	1.82	3.62	5.16

**Table 5.** Priority of Other Factors to the Least Important Factor

Least important factor	C7
The strategic importance of the project	5.16
Project characteristics	2.93
Characteristics of the contractor	3.56
Technology characteristics	1.78
Company's characteristics	4.45
IT costs	2.44
Contractor relationship quality	1

**Table 6.** Weight Ranking of the Main Factors

Main factors	Weight	Rank
The strategic importance of the project	0.2868	1
Project characteristics	0.1206	2
Characteristics of the contractor	0.1495	3
Technology characteristics	0.0779	4
Company's characteristics	0.2207	5
IT Costs	0.0941	6
Contractor relationship quality	0.0500	7
value ε*	0.571	
Compatibility Index	2.30	
Compatibility rate	0.248	

\*Optimum value of compatibility

$$w_1 + w_2 + w_3 + w_4 + w_5 + w_6 + w_7 = 1$$

$$w_1 \geq 0, w_2 \geq 0, w_3 \geq 0, w_4 \geq 0, w_5 \geq 0, w_6 \geq 0, w_7 \geq 0$$

Table 6 shows final ranking.

According to Table 6, it can be seen that the “strategic

importance of the project” with a weight of 0.2868 is the most important factor and the “Contractor Relationship Quality” with a weight of 0.05 is in the second place. The mismatch rate is 0.248, which is acceptable because it is close to zero. Finally, the percentage of final weight is calculated in Table 7.

Outsourcing occurs when one company contracts with another company to provide services or products. Outsourcing has now become an integral part of a company's IT investment strategy. On average, American companies spend 14% of their IT budget on IT outsourcing activities.<sup>15,16</sup> This study, using research and literature reviews, identified the effective factors that Ahvaz Water and Sewerage Company should consider in the field of outsourcing of IT projects, and these factors were evaluated by distributing a questionnaire in two stages. Then, the best-worst weighting and ranking of effective factors were determined by the multi- criteria decision-making technique. In response to the first question of the research, that is, what are the factors affecting the success of outsourcing IT projects in Ahvaz Water and Sewerage Company? The Delphi method findings identified 7 factors (strategic importance of the project, project characteristics, contractor characteristics, technology

characteristics, company characteristics, information technology costs and contractor relationship quality) and 26 sub-factors.

In response to the second question of the research, how is the weight of the factors affecting the success of outsourcing IT projects in Ahvaz Water and Sewerage Company? The results of the best-worst method indicated that the strategic importance of the project with a weight of 0.2868 is the most important factor and the contractor relationship quality with a weight of 0.0500 is the least important factor. Therefore, in explaining this question, it can be said that outsourcing IT projects is one of the most common creative methods to do quality work. One of the main planning steps in this field is to identify IT projects that can be outsourced. The results of this study are consistent with the results of several studies.<sup>11,12,13,17</sup> In general, according to the obtained factors, 7 factors can be considered (strategic importance of the project, project characteristics, contractor characteristics, technology characteristics, company characteristics, IT costs and the contractor relationship quality) for organizations and companies to successfully outsource their IT projects. At the level of strategic importance of a specific project, this indicator seems useful to show the success of this strategy.

**Table 7.** Comparison of Relative Weight and Final Weight Percentage of Each of the Sub-factors

Factor	Relative Weight	Sub-factor	Relative Weight	Final Weight Percentage
The strategic importance of the project	0.2868	Project contributions in achieving the main goals of the company	0.3982	0.1142
		The extent to which the project uses the company's strategic resources	0.2124	0.0609
		The confidentiality of project information	0.1731	0.0496
		The importance of the project for the future of the company	0.1411	0.0405
Project characteristics	0.1206	Save time	0.0749	0.0215
		Degree specialization of project	0.5703	0.0688
		Project complexity	0.1362	0.0164
Characteristics of the contractor	0.1495	Project size	0.2934	0.0354
		Contractor reliability	0.3873	0.0579
		Contractor's technological capability	0.2372	0.0355
		Contractor's organizational capabilities	0.1288	0.0193
Technology characteristics	0.0779	Contractor flexibility	0.1699	0.0254
		Dependence on the contractor	0.0765	0.0114
		Technology change rate	0.1519	0.0118
Company characteristics	0.2207	The complexity of required technology	0.5558	0.0433
		Novelty or maturity of technology	0.2921	0.0228
		IT staff's areas of Expertise	0.2628	0.0580
		Financial ability and facilities of the company	0.4713	0.1040
IT costs	0.0941	management support	0.1650	0.0364
		Providing employee benefits	0.1008	0.0222
		Cost of technology infrastructure	0.2884	0.0271
Contractor Relationship Quality	0.05	Operating costs within the organization	0.5659	0.0533
		Exchange fees	0.1455	0.0137
		How to communicate with the contractor	0.5787	0.0289
		Timely sharing of information	0.2784	0.0139
		No conflict between expectations and achievements	0.1428	0.0071

The manager of Ahvaz Water and Sewerage Company can first determine the strategic level of projects for implementing according to their needs and outsource high-priority projects that can use this method to carry out their activities. Also, one of these factors is the ability of the company to which the outsourced project is assigned. Necessary expertise and experience as well as having the right software and hardware are important factors in identifying the right contractor. The high ability of the contractor has a great effect on reducing uncertainty. In addition, the contractor can create the conditions for the company to use its advanced capabilities and the company's need for investment will be partly eliminated. Since in this era, human knowledge is growing daily and even momentarily, and new technologies are constantly changing and evolving the world, so the needs of society or the desires of customers of each company are also changing. All customers want the best service, but the reality is that no matter how big, strong, and up-to-date a company is, it still can't make progress on a daily basis to keep up with technology, because it can be very costly. Outsourcing has opened the way for any company to advance in and keep up with technology. Outsourcing allows using the facilities, skills and resources of another company with the most up-to-date equipment and methods, and the company only pays for the work. The results and findings of this study can be used for other institutions and public organizations Also, to play the role of a conductor for future researches in other institutions or organizations.

- Presenting a picture of the situation affecting the success of IT project outsourcing
- Helping to adopt appropriate policies and programs from the relevant officials, Also, the implementation of these programs in order to realize the operational goal of making optimal use of information technology.
- The following suggestions are also offered to other researchers:
- Identifying and ranking the factors affecting the success of outsourcing IT projects in the company or similar companies
- Identifying and ranking the factors affecting the success of outsourcing IT projects in the company with other decision-making methods such as Savara, network analysis process, hierarchical analysis process
- Investigating and prioritizing the risks of outsourcing ICT projects
- The effect of outsourcing IT projects on customer satisfaction
- Evaluation of outsourcing maturity models of project-based organizations
- Analyzing the moderating role of knowledge management capabilities and business ethics on the relationship between outsourcing risks of business activities and outsourced satisfaction
- The impact of IT Outsourcing on the success of information systems using the equation approach

## Conclusion

Therefore, based on the results obtained in the strategic importance of the project, solutions such as software design to determine the level of access of people according to their needs; Paying attention to the strategic level of projects for proper analysis of existing decisions in the outsourcing procedures of IT projects; And in relation to the characteristics of the project: reviewing the managerial and personal capabilities of the contractors before concluding the contract and using the experiences of successful domestic and foreign organizations in the field of outsourcing IT research and the characteristics of the contractor and its relationship with the company It is suggested to present the detailed plan and executive plan of IT projects by the contractors to the company, to examine the managerial and personal capabilities of the contractors before concluding the contract and to emphasize the sharing of information in a useful and complete way to prevent incomplete transfer of information to the company. Also in relation to the characteristics of technology and its costs to attract IT personnel to acquire up-to-date knowledge of those technologies, allocate funds for research and development and justify management regarding the benefits of outsourcing IT projects and in Relationship with the characteristics of the company: Creating an IT facilitation perspective and increasing the skills and knowledge of employees to do things and provide practical management support for IT projects. Results and findings of this study can be used for other institutions and public organizations Also, to play the role of a conductor for future researches in other institutions or organizations.

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## Authors' Contribution

**Conceptualization:** Fariba Nazari.

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## Competing Interests

The authors declare no competing interests.

## Ethical Approval

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