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# Evaluation of Technical Standards in the Field of Design for Consulting Projects in the Field of Design and Workshop Supervision in Provincial Gas Companies

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## Abstract

Since gas, as one of the most important carriers of energy, plays a significant role in the society's economy, especially in setting up industries, the implementation of gas supply projects in the current situation is the pulse of the society's economy, but most of the mentioned projects currently have the problem of prolonging the duration. Implementation and multiple completion costs are faced. During the pathologies conducted in the provincial gas companies, one of the most important factors of project failure is the weakness of the consultant. Therefore, choosing an efficient consultant can significantly increase the success rate of the project. Until today, there are no integrated technical evaluation tables in the field of design to identify effective indicators for the selection of consultants in provincial gas companies. In this research, we intend to conduct research on the forms prepared in the provincial gas company, as well as valid circulars, publications, and regulations regarding the preparation of appropriate and integrated criteria. In this research, a method for choosing the right consultant has been presented using decision-making techniques. First, according to the regulation of paragraph (e) of article 29 of the law on tenders and quality evaluation forms in the field of design used in provincial gas companies in order to select a consultant, the indicators were identified and to ensure the effectiveness of the identification indicators. done in the consultant selection process and all indicators affecting the selection of consultants have been identified and confirmed using the structural equation method (factorial confirmation method and T-test) and in the next step by collecting experts' opinions and analyzing the indicators by Group AHP technique and according to the group opinions of several

experts, the relative weight of each index has been determined and finally, the effective indices in the technical evaluation process in the field of design in order to select the correct consultant in the provincial gas companies have been determined.

**Keywords:** Technical evaluation form in the field of design, AHP method, Structural equation method, Provincial gas companies, Iran National Gas Company, Consulting services.

## 1. Introduction

Since the world is facing an ever-increasing demand for energy [1], for this reason, the smallest delay in reaching the goals can have a significant impact on the final goal and the time the projects will be put into operation. Therefore, it is important that the infrastructures and platforms are provided in such a way that the objectives can be planned, designed, delivered, operated and maintained. Consulting engineering companies have a fundamental role in ensuring that this is achieved [2-7]. Because by using consulting companies, in addition to quantitative achievements, it is possible to improve the quality of project goals despite limited resources and a growing population. Activities related to engineering [8-15], mapping, environmental science [16] and various forms of consulting are offered globally. Considering the complexity of the projects and the existence of experimental-engineering skills and needs, defining a routine for how to implement the projects is far from expected. Considering the complexity of the projects, the management and engineering necessary for their successful completion is complex, multifaceted and multidisciplinary. Successful implementation of such projects requires knowledge, methodology and focus [17, 18]. The consulting services industry is a mature industry capable of selecting the right team. The role played by people in the consulting company is not enough alone. The selection of new techniques and the use of suitable tools for use in complex conditions are also discussed and require the selection of qualified and quality-based consulting teams. Choosing the right consulting company for a project will increase the value of the project for investors, stakeholders and society, and reduce the risks associated with projects. Increasing value will lead to improved process, economic, commercial and environmental performance [19]. Risk reduction in all phases of the project, from planning to completion, will lead to optimal execution of operations, improved safety and environmental management, better cost control, effective management of contracts, more trust in scheduling and reduction of management differences. All these cases are proof that organizations and employers should be better aware of the importance of choosing a consultant and the impact of choosing a consultant on the overall quality of the

project. It seems that the decision to select consultants should be delegated to a group that, in addition to economic efficiency, should base their decisions on principles based on the concept of quality, which is more compatible with the expertise and final goals of the projects. This approach is more appropriate in today's modern world. In choosing consultants, emphasizing the importance of using the most suitable cost along with the most experienced and reliable consultants is the main key for evaluation. To achieve successful projects, the most suitable team (combination of optimal cost with optimal quality) and not the least expensive team should be selected. Especially, the costs of consultants' services are insignificant compared to the costs of construction projects, but the effect of consultants' services on the total costs of the project is significant [20].

Until today, integrated tables of qualitative evaluation and technical evaluation for the selection of consultants are not available in the provincial gas companies, and this issue has caused each company to deal with this issue in a tasteful way, which has caused confusion for the consultants and on the other hand, a There is no comprehensive evaluation of the consultants. In this article, we intend to research the forms prepared in the provincial gas company and similar companies, as well as circulars, publications and valid regulations regarding the preparation of standards. Let's take proper and integrated action. The subject of this thesis was chosen based on the request of provincial gas companies to have the same evaluation forms in similar consulting works. Achieving a specific and common method between provincial gas companies in the process of selecting a consultant and creating fair conditions in the selection of consultants in provincial gas companies is the main application of this research, obviously having a specific and uniform method and instructions from the employer's point of view Choosing the best consultant, from the consultant's point of view, leads to healthier competition and encourages consultants to improve the quality of their performance [21].

In today's world, there are common methods for evaluating and selecting consultants, and most of these methods are localized and used in our own country. In this regard, the "Consulting Services Procurement Regulations" have been approved by the President's Vice President for Planning and Strategic Supervision and have been notified to the executive bodies [22].

## **2. Research steps**

Since the evaluation indicators of each system will be different depending on the main goals of its creation and the important tasks expected from that system, as well as the influencing factors and the type of costs incurred [23], therefore, to identify the effective quality indicators and

Technically, the following steps are taken in selecting qualified consulting companies to cooperate with provincial gas companies in the field of workshop design and supervision. First, according to the regulation of paragraph (e) of article 29 of the law on tenders and qualitative and technical evaluation forms used in provincial gas companies in order to select a consultant, the indicators were identified and to ensure the effectiveness of the identified indicators. In the process of selecting a consultant, a questionnaire is prepared and distributed among experts. By collecting the questionnaires, all the indicators affecting the selection of consultants are identified and using the structural equation method (factorial confirmation method and T test) ) will be approved [24], in the next step, in order to determine the importance of each of the indicators, questionnaires are designed and by collecting experts' opinions and analyzing the indicators by group AHP technique [25, 26] with attention The group opinions of several experts determine the relative weight of each index, and finally the most effective indices in the currency trend.

**Table 1.** Cronbach's alpha coefficient for questionnaires

questionnaire	Variable number	Cronbach's alpha coefficients
Technical evaluation of the design	49	0.972

### 3. Results

In order to confirm the questions related to the influencing factors on the selection of consultants in provincial gas companies (technical indicators in the field of design), two charts of the standard mode and the t mode are used by using LISREL software.

1) Status of factor validation using factor loading test

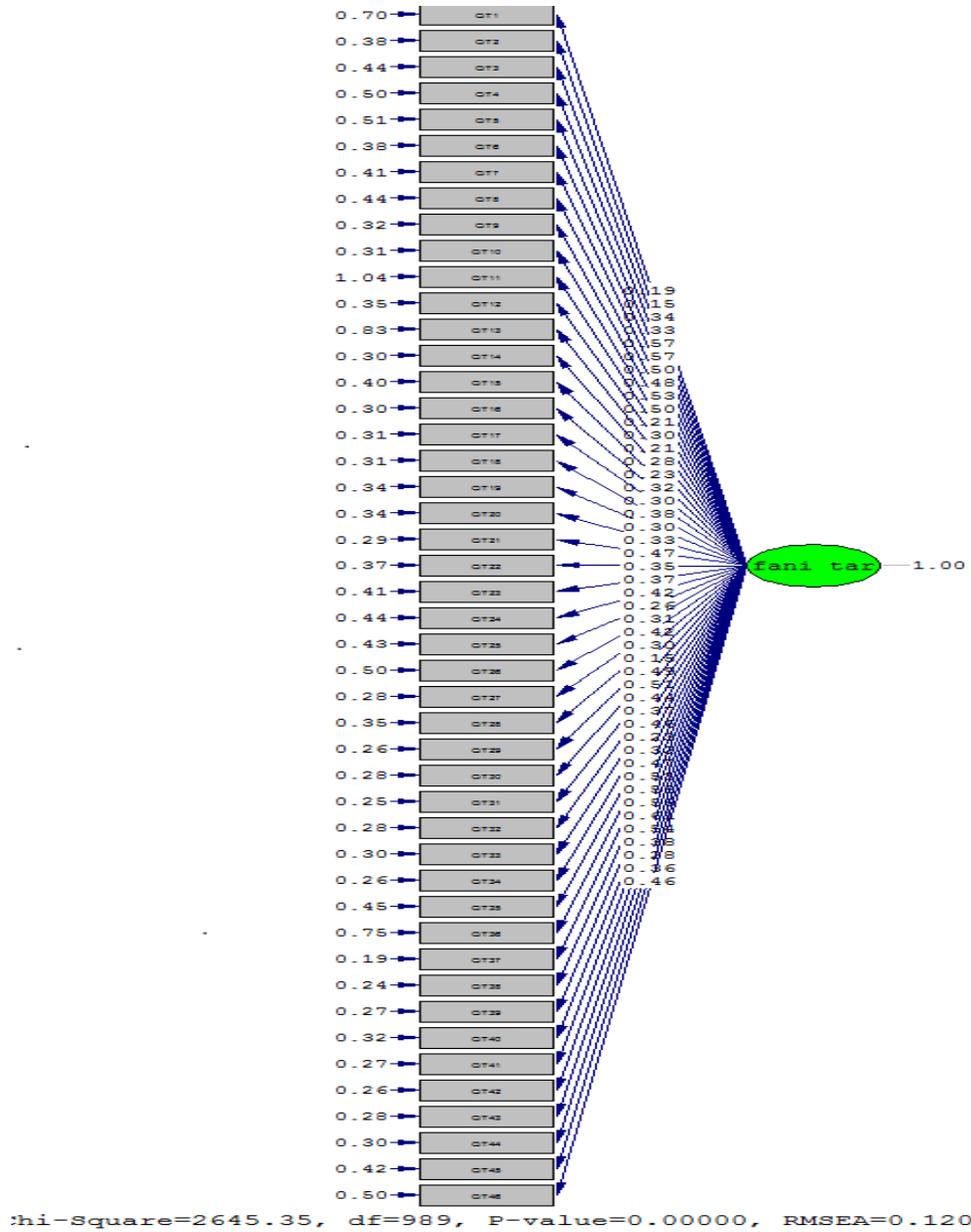
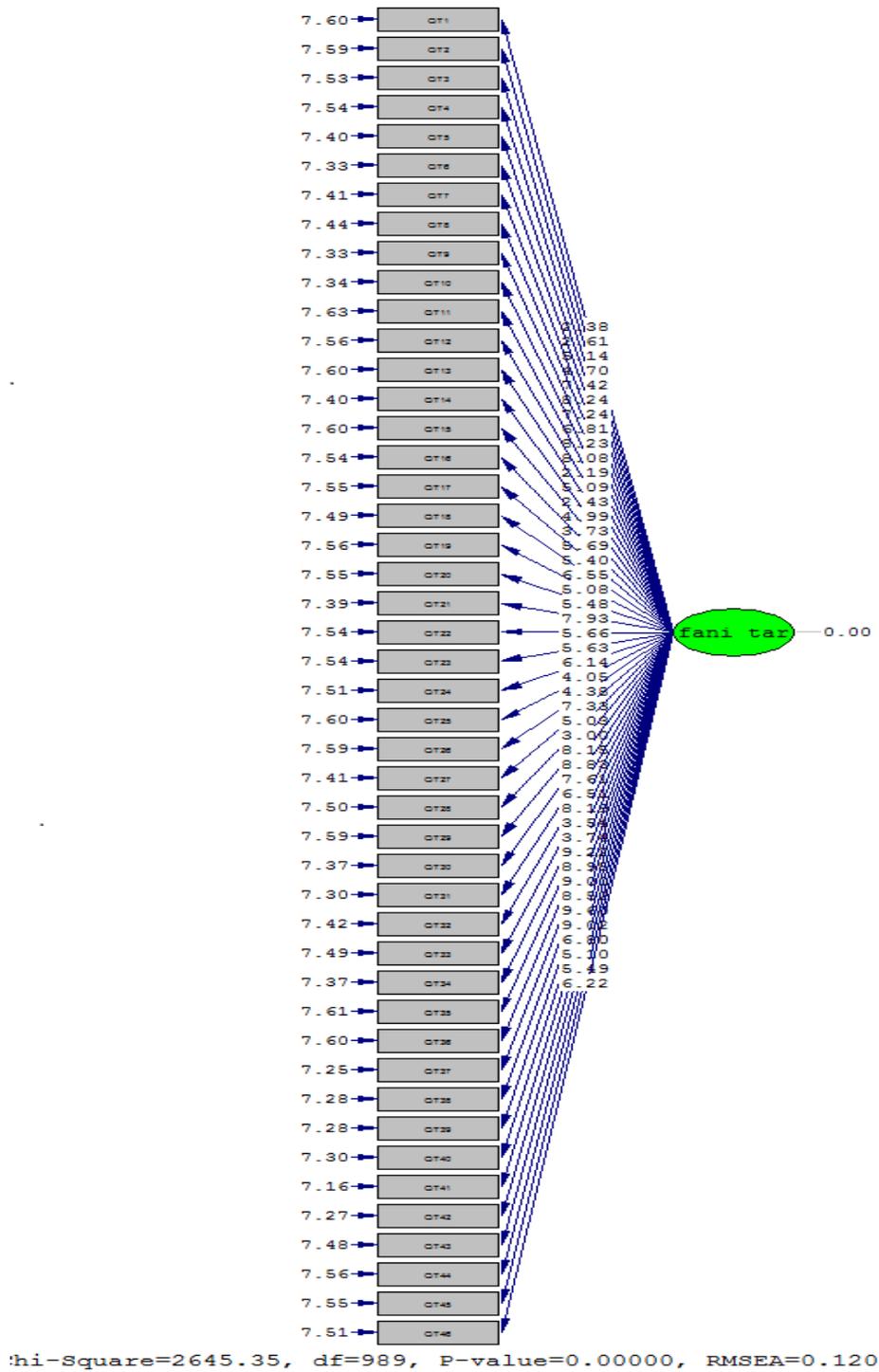


Figure 1. The diagram of the structural condition of factors affecting the selection of consultants in provincial gas companies (design technical indicators)

2) Factor confirmation using T-test:



**Figure 2.** Diagram of structural condition investigation, structural condition investigation, factors influencing the selection of consultants in provincial gas companies (design technical indicators) in t test mode

According to the output results from the analysis of LISREL software, if the value of the t statistic is lower in any of the questions related to the indicators, that question will be removed in the subsequent analysis.

**Table 2.** Structure status, structure status review, factors affecting the selection of consultants in provincial gas companies (design technical indicators)

	<b>index</b>	<b>Sub-index</b>	<b>factor load</b>	<b>T test statistic</b>	<b>condition</b>
1	Methodology	Methodology: detailed description of services [exact knowledge of the work] financial resources	0,191	0,110	0,021960
2		Methodology: Detailed description of services [description of related activities and consultant services in each part]	0,418		0,04807
3		Methodology: detailed description of services [sequential flowchart and work sequence]	0,271		0,031160
4		Methodology: detailed description of services [specialized or exclusive consultant software]	0,120		0,0138
5	How to ensure quality	How to guarantee quality: Having management system establishment certificates from reputable authorities [iso-9001 quality standard]	0,069	0,044	0,003036
6		How to guarantee quality: having management system establishment certificates from reputable authorities [having ISO-14000 environmental standard certificate]	0,034		0,001496
7		How to guarantee quality: having management system establishment certificates from reputable authorities [having OHSAS-18000 safety standard certificate]	0,049		0,002106
8		How to guarantee quality: having management system establishment certificates from reputable authorities	0,137		0,006028

		[having PMBOK and ISO10006 project management standard certificates]			
9		How to ensure quality: having management system establishment certificates from reputable authorities [using the EFQM organizational excellence model]	۰,۱۱۲		۰,۰۰۴۹۲۸
10		How to guarantee quality: having management system establishment certificates from reputable authorities [using comprehensive TQM quality management method]	۰,۰۸۲		۰,۰۰۳۶۰۸
11		How to guarantee quality: registering the company in the list of relevant institutions [National Iranian Oil Company]	۰,۰۲۱		۰,۰۰۰۹۲۴
12		How to guarantee quality: Registering the company in the list of relevant institutions [National Gas Company or Provincial Gases]	۰,۲۴۳		۰,۰۱۰۶۹۲
13		How to guarantee quality: Registering the company in the list of relevant institutions [Iranian Consultants Organization]	۰,۰۲۶		۰,۰۰۱۱۴۴
14		How to ensure quality: providing a matrix of organizational duties of the consulting body (board of directors, technical and administrative departments, etc.) RACI chart [presentation of RACI chart]	۰,۰۴۱		۰,۰۰۱۸۰۴
15		How to guarantee quality: providing settlement of accounts [providing settlement of the consultant's contract with the employer after one year of the end of the contract]	۰,۱۸۶		۰,۰۰۸۱۸۴
16	Use of tools and information technology in the consultant group	Using tools and information technology in the consultant's collection [providing checklists and review forms for design plans and As Built plans and declaring discrepancies]	۰,۳۳۳	۰,۱۵۸	۰,۰۵۲۶۱۴
17		Using tools and information technology in the consultant's collection	۰,۶۶۷		۰,۱۰۵۳۸۶

18	Technical and operational options for project implementation	Technical and operational options for project implementation and project management system [providing documentation related to technical and operational options]	٠,٣٣٣	٠,٠٨١	٠,٠٢٦٩٧٣
19	and project management system	Technical and operational options for project implementation and project management system [providing a schedule up to level 3]	٠,٦٦٧		٠,٠٥٤٠٢٧
20	Key and effective employees in the plan	Key and effective employees in the project: academic orientation and work history [doctorate and master's degree in the field of study related to 5 to 10 years of work experience]	٠,٢٠٠	٠,٠٥٨	٠,٠١١٦
21		Key and effective employees in the project: academic orientation and work history [doctorate and master's degree in the field of study related to 10 to 15 years of work experience]	٠,١٥٤		٠,٠٠٨٩٣٢
22		Key and effective employees in the project: academic orientation and work history [doctorate and master's degree in the field of study related to work experience of 15 years and more]	٠,٠٨٤		٠,٠٠٤٨٧٢
23		Key and effective employees in the project: academic orientation and work history [Bachelor's degree in a related field of study with 5 to 10 years of work experience]	٠,٠٥١		٠,٠٠٢٩٥٨
24		Key and effective employees in the project: academic orientation and work history [Bachelor's degree in a related field of study with 10 to 15 years of work experience]	٠,٠٤٢		٠,٠٠٢٤٣٦
25		Key and effective employees in the plan: academic orientation and work history [Bachelor's degree in a related field of	٠,٠٣٢		٠,٠٠١٨٥٦

		study with 15 years of work experience and more]			
26		Key and effective employees in the project: special experiences [GIS]	۰,۰۶۵		۰,۰۰۳۷۷
27		Key and effective employees in the project: special experiences [experiences similar to the desired project]	۰,۱۲۹		۰,۰۰۷۴۸۲
28		Key and effective employees in the project: special experiences [having supervision experience in projects similar to the subject of the contract]	۰,۲۴۳		۰,۰۱۴۰۹۴
29	Education Courses	Training courses: related to the field of design [design standard of steel and polyethylene networks]	۰,۱۱۹	۰,۳۱۷	۰,۰۳۷۷۲۳
30		Training courses: related to the field of design [Steel and polyethylene network design course with related software training]	۰,۴۵۱		۰,۱۴۲۹۶۷
31		Training courses: related to the field of design [regulations of gas pipe privacy]	۰,۲۶۱		۰,۰۸۲۷۳۷
32		Training courses: related to the field of design [project planning and control and MSP software]	۰,۱۶۹		۰,۰۵۳۵۷۳
33		Other cases: being native [registering the company and setting up the head office in the subject province of the contract (100 percent)]	۰,۱۱۱	۰,۲۲۷	۰,۰۲۵۱۹۷
34		Other cases: Locality [Registration of representative branch in the subject province of the contract (50%)]	۰,۱۶۱		۰,۰۳۶۵۴۷
35		Other cases: being native [doing two similar projects with the consent of the employer in the province (30 percent)]	۰,۰۱۹		۰,۰۰۴۳۱۳
36		Other cases: technical interview [technical and executive standards]	۰,۰۱۶		۰,۰۰۳۶۳۲
37		Other cases: Technical interview [Privacy regulations of Iran National Gas Company]	۰,۲۰۳		۰,۰۴۶۰۸۱

38	Other cases	Other cases: technical interview [rules of deputy planning]	٠,٠٧٢	٠,٠١٦٣٤٤
39		Other cases: technical interview [rules of the engineering system]	٠,٠٨٤	٠,٠١٩٠٦٨
40		Other cases: technical interview [social security laws]	٠,٠٥٦	٠,٠١٢٧١٢
41		Other cases: technical interview [environmental laws]	٠,٠٣٣	٠,٠٠٧٤٩١
42		Other cases: Experiences of the consultant in the last five years [3 similar jobs equivalent to Riyals (100 percent)]	٠,٠٢٩	٠,٠٠٦٥٨٣
43		Other cases: The consultant's experiences in the last five years [2 similar works equivalent to Rials and one similar work not equivalent to Rials (80 percent)]	٠,١٢٩	٠,٠٢٩٢٨٣
44		Other cases: The consultant's experiences in the last five years [1 similar work equivalent to Rials and 3 non-equivalent works (75 percent)]	٠,٠٤٧	٠,٠١٠٦٦٩
45		Other cases: The consultant's experiences in the last five years [each similar work not equivalent to Rials 14 points up to 70 points]	٠,٠٢٣	٠,٠٠٥٢٢١
46		Other cases: How to monitor compliance with health, safety and environmental requirements [How to monitor and handle HSE training of all employees working in the project]	٠,٠١٥	٠,٠٠٣٤٠٥

According to the results of T-test of structural equations, it is determined that all indicators have confirmation conditions in the analysis of structural equations. Therefore, all indicators are analyzed in the continuation of research and ranking.

Prioritizing technical factors - design:

In this section, six approved sub-indices related to facilities factors are prioritized. For this purpose, first, the group decision table related to the pairwise comparisons of the six sub-indices is presented, and their analysis and prioritization is done by Expert Choice software, and then the prioritization is confirmed by calculating the inconsistency rate.

First, a symbol is specified for each of the indicators for computational simplicity.

B1 = Methodology

B2 = How to guarantee quality

B3 = Use of tools and information technology in the consultant group

B4 = technical and operational options for project implementation and project management system

B5 = Key and effective employees in the plan

B6 = training courses

B7 = other cases

The prioritization of technical design factors using the above results is shown in the table below.

**Table 4.** Final prioritization of technical factors – design

	Index title	Index weight	Index rank
1	B1 = Methodology	0,110	4
2	B2 = How to guarantee quality	0,044	7
3	B3 = Use of tools and information technology in the consultant group	0,108	3
4	B4 = technical and operational options for project implementation and project management system	0,081	5
5	B5 = Key and effective employees in the plan	0,058	6
6	B6 = training courses	0,317	1
7	B7 = other cases	0,227	2

According to the results of the prioritization of the factors by AHP, groups are determined as shown in the above table.

#### **4 - Conclusion**

To determine the indicators that should be used as the basis of the work, four sources of information were used, and these four sources include the following:

- The indicators that were used according to the review of research literature and in similar projects and valid articles that were reviewed, these indicators are mentioned as indicators of evaluation and ranking of consultants in the field of construction projects. Was.
- The indicators mentioned in the circulars of the Program and Budget Organization.
- Indicators obtained through interviews with experts.
- Indicators extracted from evaluation forms and selection of consultants in provincial gas companies.

After summarizing the indicators and the meetings held with the experts and removing the preliminary evaluation indicators, finally, 46 sub-indices were obtained for the selection criteria of the correct consultant in the field of technical evaluation - design field, all of which were approved.

Next, the main indicators were ranked, and the priority of the indicators according to the experts is as follows:

- 1- Training courses
- 2- Other cases
- 3- Use of tools and information technology in the consultant group
- 4- Methodology
- 5- Technical and operational options for project implementation and project management system
- 6- Key and effective employees in the plan How to ensure quality

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