Procurement Management Challenges in Gas Projects of Iran

Mohammad Vafaiee, Mohammad Saleh Owlia and Mohammad Ali Vahdat
Dept. of Industrial Engineering
Yazd University of Iran

Mohsen Vafaiee
Senior Expert of Procurement Contracts

Abstract

Procurement problems are usual in gas projects in Iran, resulting in contractual claims and increased project time and cost. This study was aimed to collect the perceptions of gas projects practitioners on how significant are the procurement problems using *mean score method*. The results of the study showed that the respondents except suppliers somehow admit their own shortcomings. The client and contractor groups held extremely different perceptions and a quite strong consensus was found between the management contractor and consultant groups on the significance of the various causes of delay. It was also observed that financial problems got the highest significance and contractor problems got the lowest significance in the procurement process of gas projects.

Keywords
Procurement Management, Delay factors, Gas Projects, Iran

1. Introduction
National Iranian Gas Company (NIGC) was established in 1965 as one of the four main companies affiliated to the Ministry of Petroleum of Islamic Republic of Iran. This Company from the beginning of establishment up to now, in line with socioeconomical development growth and utilizing natural gas as one of the important sources in supplying fuel and energy production and obtaining some part of the required exchange, has gradually achieved various capabilities, competences, resources and possibilities including specialized and efficient man power with theoretical and actual insight and knowledge as well as numerous advanced workshops, machinery equipment and tools to arrange companies operations. Before1970 Iranian Islamic revolution, Utilizing natural gas for households and also industrials was limited and the number of natural gas consumers wasn't more than 50000. At the present time NIGC as one of the most reliable gas companies endeavor widely in international aspects, besides internal activities and supplying industrial fuels, power plant and household consumers, although complied extensive planning was scheduled to procure the main part of required foreign currency for the country by gas exporting and investment to help the industrial development, by utilizing experts and professional in different sectors. 497.5 million cubic meter of gas is refined daily and 30572 kilometer high pressure of transmission pipelines were constructed more than 162654 kilometers of gas distribution networking were constructed and more than 7 million branches were installed in 747 cities, gas transmission to 22975 industrial regions and delivery of natural gas to 51 power plant units.

In accordance with the fifth development plan, the significant role in supplying energy basket is corroborated [1]. This foresight is going to be fulfilled by lots of ongoing and upcoming mega projects that NIGC is considered as their client. Nevertheless, failure to comply with the existing procedures of project procurement processes caused many delays and overruns within these projects. Lots of non-preplanned contracts with too many contractors/suppliers in a great variety of project activities brought about a substantial confusion in handling these projects. Lack of a comprehensive plan for conducting the work deliveries, from the first project inception up to the project closeout, made it constantly behind the schedule and led to so many side effects on project budget. On the other hand, the excessive delays in supply of standard material, engineered material and engineered equipment faced the construction phase with the undesired delays thereby unwanted extra costs. Procurement-oriented problems are referred to problems arising from inappropriately supplying the goods and services required for a project to be properly proceeded [2]. These problems normally lead to delay and cost overrun in implementation phase [3]. In project procurement process, a delay means a time overrun either beyond the contract date or beyond the date that the parties have agreed upon for the delivery of goods and services required for the project. O'Brien believed that in both cases, a delay is usually a costly situation [4]. From the client's point of view, as NIGC is a government agency, a delay generally leads to social

inconvenience and loss of revenue, and to extreme affects, such on the national growth rate [5]. It also makes contractors suffer a loss of productivity, high disruption costs, and prolongation costs [6].

Pickavance revealed that deficient procurement management can cause project delay and affect productivity [7]. Proper practice is thus essential during the planning and procurement of the goods and services and in the operation of the contract [8]. Many researchers have conducted surveys on the causes of delay in the construction industry; some of these are summarized in Table 1. As it is obvious from this table, in most of the cases "Procurement Problems" is one of the root causes of delay in worldwide construction projects. This problem can be particularly seen in the developing countries. In modern countries such as U.S. and Canada this factor has less intensity.

Table 1. Summary of previous studies on causes of delay & cost overrun in construction industry

Researchers	Country	Problems led to delay and cost overrun
Baldwin (1971)	U.S.	1. inclement weather 2. labor problems
Arditi, et al. (1985)	Turkey	1. *procurement problems* 2. financial difficulties faced by public agencies and contractors 3. organizational deficiencies 4. delays in design works 5. frequent change orders / design 6. considerable additional work
Semple et al. (1994)	Canada	1. increases in the scope of works 2. inclement weather 3. restricted access
Mansfield et al. (1994)	Nigeria	1. improper financial and payment arrangements 2. poor contract management 3. *procurement problems* 4. inaccurate cost estimates 5. fluctuations in cost
Ogunlana et al. (1996)	Thailand	1. *procurement problems* 2. changes of design 3. liaison problems among the contracting parties
Mohan R. Manavazhi. et al.(2002)	Nepal	1 *procurement problems* 2. failure to pay for completed works 3. poor contract management
Al-Khall & Al-Ghafly (2006)	Saudi Arabia	1. cash flow problems / financial difficulties 2. difficulties in obtaining permits 3. *procurement problems*
Lo T. Y. et al.(2006)	Hong Kong	1. delays in payment by agencies to contractors 2. fluctuations in materials, labor and plant costs
Murali Sambasivan. et al.(2007)	Malaysia	1.Unrealistic contract's conditions 2.Client interfering 3.Slow make decision
G. Sweis. et al. (2008)	Jordan	1. financial problems 2. change orders / design 3. inclement weather 4. change public rules 5. *procurement problems*

A preliminary investigation was conducted in early 2005 by the Planning and Development Division of NIGC to examine the main reasons for project delays in gas mega projects in Iran that were completed between 1998 and 2004 [9]. It was observed that no gas mega project was completed within schedule, with average overrun time exceeding 60% and average overrun budget going beyond 20%. This study was aimed to gather the perceptions of gas industry practitioners on how significant the causes of procurement-oriented problems are by using of some statistical analyses.

2. Research Methodology

The impacts and causes of procurement-oriented problems of Iranian gas mega projects were first examined and identified through a relevant local literature review and by conducting a pilot study that sought advice from experienced practitioners working in this field. In order to identify the right persons for interview, the organizational structure for Iranian gas mega projects was initially recognized (see Fig. 1).

As indicated in figure 1, client (NIGC) contracts with an external engineering firm to provide design and technical requirements. On the other hand, client contracts directly with an MC to provide overall project management for the project. MC contracts directly with a supplier and a PC (Procurement and Construction) contractor to provide Procurement management and construction/installation management/services for the project.

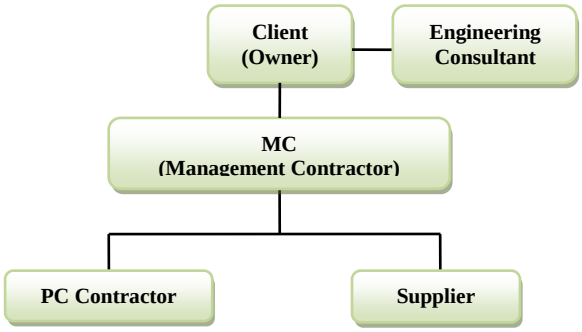

Fig.1.Organizational Structure for Iranian Gas Mega Projects

In view of the above, the client, the MC, the contractor, the consultant engineering and the supplier were identified as the main stakeholders seriously involved in the project procurement processes and thus 30 interviews were arranged with these parties key contact persons to obtain exact information toward the project procurement-oriented problems. The project main parties at interest in our samples involved in the procurement process that were included in this study are summarized in Table 2.

Table 2: Main parties at interest in the procurement process

Client(NIGC)	IGEDC(Iranian Gas Engineering and Development Company) IGCC(Iranian Gas Commercial Company)
MC(Management Contractor)	Ghods Niroo Co.
Contractors	Iran Ertebat Co., Peysa Co, Khatamolanbia Co.
Engineering Consultants	Pars Co., Bina Co.
Suppliers	Profile Saveh Co., Godakhtar Co.

It was tried to keep interviews on track through asking relevant questions in a structured manner. In this regard, interview topics were categorized according to the following items:

- Major procurement-oriented problems in viewpoint of interviewees.
- Causes of the problems.

As a result, 30 common procurement-oriented problems (see Table 3) related to Iranian gas mega projects were selected for furtherr examination in this study.

Based on the information obtained from interviews, a set of questionnaires was formulated in which the procurement-oriented problems were grouped into seven categories, accordingly designated with code names.

In this survey, five groups of practitioners were defined, comprising a client group (including IGEDC and IGCC), a consultant group, a MC group, a contractor group (including contractors who can tender for contracts of scope involving both P & C portions and who are listed in the NIGC gazette, listed under the procurement and construction categories for the purpose of carrying out gas mega projects) and a supplier group.

The questionnaire contained 30 identified procurement-oriented problems for which the respondents were asked to indicate their perceived magnitude of significance with reference to a corresponding 1-5 scale as following:

1=not significant (NS)
2=slightly significant (SS)
3=moderately significant (MS)
4=highly significant (HS)
5=extremely significant (ES)

A total of 74 copies of the questionnaire were sent to randomly selected samples. The samples were selected from publicly available sources, including the NIGC and its subsidiaries, also consulting engineering companies

and professional contractors as well as MC and suppliers companies working in the gas industry. As a result, 65 responses (see Table 4) were received, giving a response rate of 88%.

Table 3: List of 30 identified procurement-oriented problems in Iranian gas projects

Code Name	Category of Problem	Procurement-oriented problem statement
CL1	Client Related	Slow coordination & seeking of approval from concerned authorities
CL2		Decentralization purchases and procurement in a little size
CL3		Exceptionally low bids for E, P or C portions
CL4		Deficient project management & supervision by MC
CL5		Taking project from illegal way
CL6		Unrealism in predicting project duration by NIGC
EN1	Consultant Related	Continual changes in engineering phase
EN2		To lengthen process of converting one indent to one order
EN3		Delay in investigation of procurement technical documents
EN4		Poor basic engineering(design)
CN1	Contractor Related	Inattention about after sales services such as guaranty and warranty
CN2		Inexperienced contractor (both technically & commercially)
CN3		Incapable control to logistic processes
MS1	Supplier Related	Difficulties in supplying row material
MS2		Inactivate R&D department in some suppliers
MS3		Privatization of some public companies
IS1	Infrastructure Issues	Directors frequent replacement thus company's policy alteration
IS2		Insufficient supportive legislation forcing local banks to financially assist gas industry
IS3		Political constraints such as boycott
IS4		Impacts of the Act of 51% domestic portion for the project budgetary plan
IS5		Tremendous domestic inflation rate and its impact on local manufacturers/suppliers productivity
FB1	Financial and Banking Issues	Existence of high bank rate
FB2		Too complicated procedures for opening LC through Iranian issuing banks thereby excessive delays
FB3		Lack of enough financial resources to finance project
FB4		Not payment of facilitates to suppliers by domestic banks in return project contract and request self assurance
LC1	Legal and Contractual Issues	To lengthen of preparing and offering bid's documents
LC2		To be sideway of NIGC's contracts
LC3		To request heavy assurance in content of contract
LC4		Replacement of Bids Law with national petroleum company's regulation and there are some obscurities
LC5		Inability of adjustment in domestic transaction's contracts

Table 4: Summary of Response Rates for Different Groups

Group	Questionnaire Sent	Completed Questionnaire Received	Response Rate (%)
Client	*32*	*28*	*87.5*
Consultant	*9*	*9*	*100*
Contractor	*18*	*16*	*88.89*
MC	*6*	*6*	*100*
Supplier	*9*	*6*	*66.67*
Overall	*74*	*65*	*87.84*

3. Results and Discussion

The respondents in the client, MC, consultant, supplier and contractor groups were from different working positions and their working experience ranged from 4 to 35 years. It is also noted that the average working experience of the respondents was 16 years in the gas industry, and thus the opinions are thought to reflect the real situation in the industry.

The reliability of a measure illustrates its stability and consistency, which assists in evaluating the "goodness" of a measure. The reliability coefficient-Cronbach's α- obtained with SPSS software, measures how well a set of variables or items measures a single, unidimensional latent construct. If alpha is high (0.70 or higher), then this suggests that all of the items are reliable and the entire test is internally consistent. The measure, therefore, were

considered to be reliable. Furthermore to determine the validity of instrument, factor analysis was applied [10]. KMO index was used to test sufficient correlations between each factor's variables to justify the application of factor analysis (if KMO equal or higher than 0.6). Table 5 shows the results of reliability and validity tests.

Table 5. Summary of Approval Factor Analysis for different causes of delay

Factor number		*1*	*2*	*3*	*4*	*5*	*6*	*7*
Reliability	Alpha	*0.711*	*0.655*	*0.833*	*0.824*	*0.574*	*0.759*	*0.693*
Validity of sufficient sampling	KMO	*.583*	*.623*	*.722*	*.611*	*.619*	*.718*	*.739*
Bartlett's Test of Sphericity	BT	*129.73*	*50.27*	*145.35*	*380.4*	*28.06*	*83.93*	*61.48*
	d.f.	*66*	*10*	*45*	*190*	*10*	*21*	*15*
	Sig	*.000*	*.000*	*.000*	*.000*	*.002*	*.000*	*.000*

3.1. Ranking of Significance and Effectiveness Using Mean Score Method

The following equation is utilized to calculate the mean score (MS) for each identified problem: [11]

$$MS_i = \frac{\sum(f \times S)}{N} \quad (1)$$

Where

S = score given to each problem by the respondents

f = frequency of responses to each score for each problem

N = total number of responses in the respective groups for the respective problem

i = respective problem

To suit the case of this study, this formula was adopted to calculate the significance of the procurement-oriented problems, and weights were put onto individual scores (ES=5, HS=4, MS=3, SS=2, NS=1). The mean scores of the procurement-oriented problems were calculated and the relative rankings of their significance were obtained in descending order (see Tables 6).

The overall mean scores (OMS) and individual rankings are also presented there. These were calculated using the following equation:

$$OMS = \sum_{i=1}^{5} MS_{ij} \times \left(\frac{Ni}{N_1 + N_2 + N_3 + N_4 + N_5} \right) \quad (2)$$

Where i = Group 1, 2 … 5;

MS = mean score;

Ni = number of respondents in each group

j = jth item in a group.

The respondents' perceptions of the significance of procurement-oriented problems have been summarized in Table 7. In this table, the mean scores of the problems are presented within defined categories and ranked according to significance. It was observed that the viewpoints held by the Client, MC, contractor, consultant and supplier groups toward the significance of the various problems were different. This is illustrated by ranking of the categories in Table 7.

3.2. Percentage Agreement and Disagreement

Tommy Y. Lo et al. (2006) proposed equations (3) and (4) to evaluate the extent of agreement in ranking between different pairs of respondent groups, and called them percentage disagreement (PD), and the percentage agreement (PA) by the following equations:

$$PD = 100x\sum_{i=1}^{N} |R_{i1} - R_{i2}| / |R_{x1} - R_{y2}| \quad (3)$$

Where i=1,2,. . ., N items and R_{i1} and R_{i2}=ranking of the ith item in groups 1 and 2, and lastly x and y are represented the ranking of the items, $y=N-x+1$ (i.e., if x=1 and N=30, y=30−1+1=30)

$$PA = 100 - PD \quad (4)$$

Table 8 shows the results of PA and PD calculations based on the analysis of different stakeholders views on the various causes of delay.

Tables 6: Mean Score and Ranking of Significance of Identified Top Ten Procurement-Oriented Problems

Identified Procurement-Oriented Problems		Client		Consultant		Contractor		MC		Supplier		Overall	
Description	Code Name	Mean Score (MS)	Rank	Mean Score (MS)	Rank	Mean Score (MS)	Rank	Mean Score (MS)	Rank	Mean Score (MS)	Rank	OMS	Rank
Political constraints such as boycott	IS8	*4.48*	*1*	*4.75*	*1*	*4.44*	*2*	*4.5*	*2*	*4.33*	*10*	*4.492*	*1*
Tremendous domestic inflation rate and its impact on local manufacturers/suppliers productivity	IS5	*4.11*	*4*	*4.22*	*3*	*4.38*	*4*	*3.83*	*23*	*4.5*	*5*	*4.203*	*2*
Insufficient supportive legislation forcing local banks to financially assist gas industry	IS3	*4.12*	*2*	*3.89*	*11*	*4.19*	*10*	*3.67*	*31*	*4.67*	*1*	*4.114*	*3*
Exceptionally low bids for E, P or C portions	CL 8	*4.11*	*3*	*4*	*7*	*4.06*	*23*	*3.83*	*22*	*3.83*	*33*	*4.031*	*4*
To lengthen process of converting one indent to one order	EN 2	*4*	*6*	*3.75*	*16*	*4.06*	*18*	*4*	*12*	*4.33*	*7*	*4.015*	*5*
Difficulties in supplying row material	MS 3	*3.88*	*12*	*3.78*	*13*	*4.25*	*8*	*4.33*	*4*	*3.67*	*37*	*3.965*	*6*
Not payment of facilitates to suppliers by domestic banks in return project contract and request self assurance	FB 4	*3.91*	*10*	*3.78*	*14*	*4.31*	*7*	*3*	*59*	*4.33*	*8*	*3.948*	*7*
Deficient project management & supervision by MC	CL 10	*4*	*5*	*4*	*5*	*3.94*	*31*	*3.67*	*29*	*3.67*	*35*	*3.923*	*8*
Inexperienced contractor (both technically & commercially)	CN 1	*4*	*7*	*3.67*	*23*	*4.25*	*9*	*3.6*	*34*	*3.33*	*56*	*3.922*	*9*
Continual changes in engineering phase	EN 4	*3.85*	*15*	*3.5*	*35*	*4.06*	*20*	*4.25*	*6*	*4.17*	*16*	*3.918*	*10*

Table 7: Overall Mean Scores and Rankings of Categorized Procurement-Oriented Problems for Different Groups

Procurement-Oriented Problems		Client		Consultant		Contractor		MC		Supplier		Overall	
Category	Code	Mean Score	Rank	Mean Score	Rank	Mean Score	Rank	Mean Score	Rank	Mean Score	Rank	Mean Score	Rank
Financial and Banking Issues	FB	*3.784*	*1*	*3.448*	*5*	*4.022*	*2*	*3.506*	*5*	*4.166*	*1*	*3.816*	*1*
Consultant Related	EN	*3.672*	*3*	*3.494*	*2*	*4.05*	*1*	*3.75*	*1*	*3.9*	*3*	*3.776*	*2*
Supplier Related	MS	*3.556*	*4*	*3.843*	*1*	*3.773*	*6*	*3.454*	*6*	*3.506*	*6*	*3.774*	*3*
Infrastructure Issues	IS	*3.694*	*2*	*3.461*	*4*	*3.918*	*3*	*3.564*	*3*	*4.003*	*2*	*3.736*	*4*
Client Related	CL	*3.484*	*6*	*3.486*	*3*	*3.817*	*4*	*3.535*	*4*	*3.689*	*5*	*3.657*	*5*
Legal and Contractual Issues	LC	*3.526*	*5*	*3.31*	*6*	*3.762*	*7*	*3.574*	*2*	*3.844*	*4*	*3.657*	*5*
Contractor Related	CN	*3.417*	*7*	*3.167*	*7*	*3.79*	*5*	*3.295*	*7*	*3.275*	*7*	*3.427*	*7*

Table 8: Percentage Agreement (PA) and Percentage Disagreement (PD) for Significance of Delay

Stockholders Groups	Percent Agreement(PA)	Percent Disagreement(PD)
Client & Contractor	*41.10*	*58.90*
Client & Consultant	*42.90*	*57.10*
Contractor & Consultant	*44.70*	*55.30*
Client & Supplier	*45.45*	*54.55*
Contractor & Supplier	*49.91*	*50.09*
Client & MC	*50.47*	*49.53*
MC & Supplier	*52.27*	*47.73*
Supplier & Consultant	*57.67*	*42.33*
Contractor & MC	*58.05*	*41.95*
MC & Consultant	*59.94*	*40.06*

4. Conclusion

Referring to the results of the study based on assessment of top ten causes of delay showed that, respondents except suppliers tended to admit somehow their own shortcomings. The client and contractor groups held extremely different perceptions regarding the significance of various delay causes (with Percent

Disagreement=59%).And a quite strong consensus was found between the management contractor and consultant groups on the significance of the various causes of delay (with Percent Agreement=60%). It was also observed that financial problems got the highest significance and contractor problems got the lowest significance in the procurement process of gas projects. Three out of ten of the most significant procurement-oriented problems were relevant to infrastructure issues including political constraints such as boycott (IS3), insufficient supportive legislation forcing local banks to financially assist gas industry (IS2), tremendous domestic inflation rate and its impact on local manufacturers/suppliers productivity (IS5). The results show that these problems have a substantial relationship with government and their solutions are out of stockholders' authorities. In order to mitigate procurement-oriented problems and improve the overall productivity in the procurement processes of gas industry, the following strategies must be properly situated:

1. In order to force local banks to support gas industry, NIGC authorities are required to propose competent statutes to the parliament for approval enforcing banks to financially assist gas industry. In this regard, banks are demanded to assign suitable lines of credit comprising loans with low interest rate to the gas mega projects against the contract itself not in return of tremendous bonds.
2. To avoid excessive delays resulting from too complicated procedures for opening LC through Iranian issuing banks, banks are to adopt updated methods for opening LC and give up the traditional routine paperwork and administrative formalities. Utilization of E-LC (Electronic Letter of Credit) as applied nowadays in so many countries would help.
3. To prevent shortage of financial resources to finance project procurement activities, client is essential to foresee the entire budget, including contingency, required for the project proper completion and to negotiate the relevant financial institutions to establish necessary lines of credit at the pre-project planning phase.
4. Government authorities had better develop in advance the infrastructures for the location areas of gas mega projects. In this respect, NIGC is required to take into account this critical issue at the pre-project planning phase to avoid inadequate utilities in the project location area for the procurement processes.
5. Although the price growth of raw material such as steel sometimes cannot be thoroughly predictable, Contractors should expedite ordering for long delivery items as well as engineered material/equipment that are composed of steel as a main component to reduce the impact of international growth in the price of these material.
6. In order to mitigate the side effects of political constraints such as sanction and/or embargo, client is to be more cautious about the technology selection and the licensing agency at the project outset not to include countries politically in conflict with Iran. Correspondingly, government has to establish better trade relationship with the modern countries uninvolved in the sanction/embargo against Iran.

The findings provide some guidelines and applicable information that gas industry stakeholders can utilize to manage the procurement process of their mega projects properly and shed light on the mitigation of procurement-oriented problems and improve the overall productivity in the gas industry. Perhaps setting some milestones and priorities are required so that improvement can be achieved in a progressive manner.

References

1. http://en.nigc.ir.
2. Chan, D. W. M., and Kumaraswamy, M. M., 1996, "Reasons for delay in civil engineering projects—The case of Hong Kong." Hong Kong Inst. Eng. Trans., 2(3), pp. 1–8.
3. Baldwin, J. R., 1971, "Causes of delay in the construction industry." J. Constr. Div., Am. Soc. Civ. Eng., 97(2), pp. 177–187.
4. Assaf, S. A., 1995, "Causes of delay in large building construction projects." J. Manage. Eng., 11(2), 45–50.
5. Assaf, S. A. and Al-Hejji, S., 2006, Causes of delay in large construction projects, International Journal of Project Management, 24, pp. 349–357.
6. Arditi, D., 1985, "Reasons for delays in public projects in Turkey." Constr. Manage. Econom., 3, pp. 171–181.
7. Aibinu, A.A. and Jagboro, G.O. 2002, The effects of construction delays on project delivery in Nigerian construction industry, International Journal of Project Management, 20, pp. 593–599.
8. Sambasivan, M. and Soon, Y. W., 2007, Causes and effects of delays in Malaysian construction industry, International Journal of Project Management, 25, pp. 517–526.
9. Sweis, G., 2008, Delays in construction projects: The case of Jordan, International Journal of Project Management, 26, pp. 665–674.
10. Robert, H,, 2006, Handbook of univariate and multivariate data analysis and Interpretation with SPSS, 1st Ed., Chapman & Hall/CRC, pp. 203-243.
11. Lo T. Y., 2006, "Construction Delays in Hong Kong Civil Engineering Projects", ASCE J. Constr. Engrg. and Mgmt., 132(6), pp. 636-649.