African Journal of Business Management Vol. 6(15), pp. 5218-5225, 18 April, 2012
Available online at http://www.academicjournals.org/AJBM
DOI: 10.5897/AJBM11.2437
ISSN 1993-8233 ©2012 Academic Journals

Full Length Research Paper

Construction project success analysis from stakeholders' theory perspective

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Accepted 8 November, 2011

The purpose of this study is to investigate to what extent stakeholders' project performance correlate to project success. To collect the empirical data, a particular questionnaire was designed and distributed among owners, consultant and contractor companies who are number 1 in performing oil, gas and petrochemical projects in Iran. The results of the research show that consultants play the most important role and owners the least in determining project success. And technical aspect of consultant and contractor performance has been used as the most important criterion of project success. Other theories, other type of projects, other companies and countries should be investigated to generalize the findings. This research concluded that consultants play the most important role in determining project success and technical aspect of their performance is the most important criterion for project success. Consequently, project success can be enhanced by focusing on consultants' performance and other aspects of performance such as human, organizing and integration aspect in addition to technical aspect. To what extent stakeholders' project performances correlate with project success is studied in this research paper.

Key words: Stakeholder theory, project success, power, oil, gas, and petrochemical project.

INTRODUCTION

The purpose of the present paper is to examine Iran's power, oil, gas and petrochemical projects success from the perception perspective of engineers employed by 3 key stakeholders including; project owner (PO) who is the investor of the project and is responsible for all financial affairs; project management consultant (PMC) who take the responsibility of controlling the project from time, cost and quality and safety point of view; finally, project contractor (PC), who shall perform and manage the project according to the bilateral signed contract. Particularly, the main concern of this paper is, first, to find out the evaluation of projects by Iranian engineers. Then, to show the correlation between stakeholders project performances and project success. So, the hypotheses can be declared as: "Iran's power, oil, gas and petrochemical projects success has positively correlated to the performances of their stakeholders".

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THEORETICAL BACKGROUND

Project success

The authors have not reached a consensus about project success criteria yet, while project success has been discussed profoundly. Traditionally, project success was evaluated from the iron/golden triangle; time, cost and quality perspective. For example, Mark and Jones (2003) has used this definition for project success in his studies. But, nowadays, Project success is, also, measured through many other aspects such as organizational objectives, stakeholders' satisfaction, customers benefit, future potential to organization, etc. Generally, most of the studies have focused on the factors influencing project success and on the ways in which it is measured (Amit, 2008).

Since the objectives of the project are different and are influenced by sets of success factors, the various stakeholders perception of the project success and success factors are different too (Oliver and Rowlinson,

2010). For example, contractor perception of project success depends upon his achievement. It is almost impossible to provide a list of success factors which can be influential to the projects, because they could be different from project to project. Various parties involving in a project look at project success from two different viewpoints: macro and micro, (Jing et al., 2009). Macro viewpoint is the one which is looked by stakeholders and users. It deals with the overall and original achievement of project concept. But micro viewpoint cover the lower level of project like those parties involved in the project construction phase (Go¨ran and Lindahl, 2007). The main concerns of the contractual parties involved in the construction phase are main project management goals such as time, cost, quality, safety. At micro level, the perception of project success varies from one party to another (Peltokorpi et al., 2008).

The goals of designers and the contractors are different from those of the owners. The designers and contractors expect more on profits while the owners are more interested in finishing their projects on time and on budget (Heywood and Smith, 2006; Meeampol and Ogunlana, 2006). Used measures such as the amount of rework, schedule performance, and budget performance to measure the success of projects. In addition, (McVea, 2005) also used cost, schedule, quality, safety, and participant satisfaction as the characteristics of a successful project. As seen in the works of Nunnally, 1978 and Udechukwu et al., 2008, budget performance and time performance always fall into one of the top five of the main project objectives (Akintola, 2007).

In order to make it easier to get a global approach, different categories of success factors have been used in the articles. Each success factor has been divided into four groups: the project, the project manager and the project team members, the external environment and the organization (Van Der Westhuizen, 2005). Beside these, Fornell and Larcker (1981) discussed the difference between project success and project management success where project success follows long term objective and is more general while the project management success is oriented towards short term goal. To be clearer, consider delivering the construction project focusing project management success by a construction project manager and project success perspective of facility planner of a large organization with long-term business planning (Derek and Walker, 2000).

Accepting the definition presented by Project Management Institute (PMI), authors will reach a consensus about of project success definition. PMI has announced the golden triangle and key project stakeholder satisfaction of the project as project success criteria.

Stakeholders

Since Freeman (1984) defined stakeholder as: "all the people including the team families, people made redundant by the changes introduced, people who buy the product and the local community who receive no direct benefit from project but their lives or environment are affected by it", (Kline, 1998), and introduced stakeholder theory to strategic management, many papers focused on stakeholder definition in various journals as mentioned earlier (André, 2008).

We accept classical definition of stakeholder discussed by Freeman (1984) as he defines it as: "an individual or a group who can affect or is affected by the implementation of the change project" (Dillman, 2000).

In the engineering and construction industry and within the communities surrounding each site, Stakeholders are seen to include a variety of entities such as government and other non-profit organizations that directly or indirectly can provide support or resistance to the accomplishment of project objectives (Bagozzi and Yi, 1988).

Also, Laplume has categorized stakeholders as: Internal stakeholders and external stakeholders. Where internal stakeholders can include owners, customers, employees, and suppliers and external stakeholders include governments, competitors, consumer advocates, environmentalists, special interest groups, and the media (Fornell and Larcker, 1981).

There are three key stakeholders involved in every construction project whose project performances play as an important role in determining project success. The stakeholders includes; project contractor (PC) whose duty is performing the construction according to relevant technical, management and contract specifications; project owner (PO), A company appointed as the owner of a government funded construction project who procure construction contractor through bidding/tendering and takes the financial responsibility and other relevant responsibilities of the project; project management consultant (PMC), who takes their technical, organizational and human responsibilities and the responsibility of controlling the project from time, cost and quality and safety point of view.

As Freeman's (1984) stakeholder theory has been used in various areas such as corporate responsibility (Wang and Huang, 2006), business ethics and project management (Kenneth and Reed, 2004), and because of instrumental or strategic nature of stakeholder theory, the inclusion of stakeholders in project processes is increasingly recognized as an important factor in delivering satisfactory project outcomes (Fro¨dell, 2008).

This stream has generally focused on the way in which relationships with stakeholder groups are managed, and on the impact of stakeholders on the firm, employing means-ends reasoning (Karlsen et al., 2008).

RESEARCH METHODOLOGY

In this research which is an empirical one, based on the theoretical

background, cost, time, quality, relation and overall success were considered as the indicators of project success. According to the mentioned items, a special questioner was designed to survey companies involved in Iran's power, oil, gas and petrochemical construction projects. A five-point scale from 1 (very poor) to 5 (excellent) was applied to scale the indicators. The companies were asked to answer the questions based on one of the projects they have worked on optionally. This research is an applied one in which survey method has been used to gather information and analyzing results.

Also based on the above theoretical background, this research has measured the stake holder's performances as follow:

The project performance of PC has been measured using the four variables; technical performance, organizing performance, human performance and integration performance and specification performance.

The project performance of PMC has been measured using the four variables; technical performance, organizing performance, human performance and integration performance.

The project performance of PO has been measured using the two variables; procurement and supporting PMC.

Further, the companies were requested to ask one of their engineers to answer the questions based on one of the projects they have worked on, optionally. Forty one measuring items are shown as indicators of the above 10 variables, which are on a five-point scale from ‘‘1 strongly Disagree’’, ‘‘2 Disagree’’, ‘‘3 no idea’’ ‘‘4 Agree’’, ‘‘5 strongly Agree’’ to ‘‘5 no idea’’.

Some items such as age, education, years of experience, project type, and completion percentage of the project were also included in the questionnaire to collect background information of the respondents and their projects. The questionnaire was pre-tested through a small pilot study before the formal survey administration. The measuring items for project success are shown in the Table 1.

To conduct the survey, totally 201 companies; 153 contractors, 44 consultants, and 4 owners were selected from the lists provided by their association sorted by owning number 1 qualification grade in performing projects in oil, gas, power and petrochemical fields. The sample size, 113 responders, was obtained through the equation $n = \frac{z^{2}\frac{\alpha}{2}.p(1-p)^{2}}{\varepsilon^{2}}$ in which α (confidence interval) equals 95%, p equals 25%, based on an initial sampling as 30 companies, and ε (estimation accuracy) equals 0.08. Each company was sent a copy of the questioner; with 201 copies totally distributed. They were asked to assign an employee to answer the questions based on an optional project on which he/she has worked on. The survey was conducted in September and October 2010 and resulted in 118 valid responses. The main characteristics of respondents and their projects are presented in Tables 2 to 4.

RESULTS

The reliability of the questioner of this research was measured by Cronbach’s alpha coefficient. This coefficient which is used to measure the internal consistency of research constructs is the most applied tool to measure the reliability in operation management researches (Shamas-ur-Rehman and Stephen, 2009). To be reliable, this coefficient must have a value greater than 0.7 (Nunnally, 1978). α coefficient values for the questioner in general and also separately for each of various constructs have been shown in Table 5. The validity of this research has been measured from two viewpoints: construct validity and content validity. First of all, the questioner was distributed among a few respondents and professors to have their comments on the questions clarity. Then, the action was taken to plain the questions according to what they declared. The construct validity was guaranteed in this way. Next, the content validity was, based on collected data, measured by exploratory factor analysis through principal components and Varimax rotation analysis methods. Also by confirmatory factor analysis through structural equation modelling in Lisrel 8.5 software. The results are as follows.

Constructs factor analysis

Each of the four constructs of the research was analyzed through factor analysis individually. The results were satisfactory in all constructs including; success, owner and contractor performances. But, the variable “consultant performs well in making trade-off among project sub-objectives” included in consultant performance constructs has a low communality as much as 0.119 and was deleted accordingly.

Exploratory factor analysis was performed on obtained structures by Lisrel 8.5 software to make sure that the explained factor analysis has required good of fitness and needed modifications was done.

All indexes presented by Lisrel 8.5 software are designating that factor structure fit the research data well. Fitness indexes of exploratory and confirmatory factor analysis for all constructs have been shown in Table 6.

Only one component was extracted from all constructs which is designating high converges validity for all constructs. The explanatory and confirmatory factor analysis has been presented in the Table 6.

The values greater than 0.5 and less than 0.4 are indicating validity convergence and divergence of constructs, respectively. Also, the existence of more than one component in constructs modelling is the sign of one-dimensional validity (Fornell and Larcker, 1981). Moreover, the values less than 0.09 for RMSEA (Dillman, 2000), the value less than 0.05 for P-Value (Kline, 1998), and the values less than 3 for (χ^{2}/df) (Bagozzi, 1988) show that the factor structure fit the data well, and are designating one-dimensional convergence and divergence validity (Nunnally, 1978). Accordingly, the construct validity is certified once again. The results obtained from exploratory and confirmatory factor analysis, and the path in which they were analyzed, show desired validity in the research constructs.

Testing the model of the research

The constructs of the research were identified (calculated) and their model was built by Lisrel 8.5 software to test the model of the research. After modelling, it was found that T- value correlation between

Table 1. Measuring items.

Measuring items of project success	Measuring items of owner performance	Measuring items of consultant performance	Measuring items of contractor performance
	1) Supporting MC	**1) Integration performance**	**1) Specification performance**
1) The overall project success	1.1) PMC was motivated by the owner to treat contractor fairly.	1.1) PMC coordinated the sub-objectives of the project well.	1.1) PCs claims was actual and in line with contract items.
2) The relationship among 3 Main stakeholders of the project; contractor, MC, and owner.	1.2) All changes to project were approved by PMC.	1.2) The head of MC was more Generalist than technical specialist.	1.2) PC acted based on contract administration system.
3) Cost performance of projects.	1.3) PMC was independent in professional performance of	1.3) PMC was the only responsible entity of the project.	1.3) PC acted well based on the common PM of the projects administration practices.
4) Schedule performance Of the Projects	1.4) PMC was authorized by the owner to certify the works Performed by contractor.	1.4) There was a Main-Supervising-Engineer-Responsibility System.	1.4) PC acted well according to technical specification.
5) Quality performance of the Projects	1.5) PMC was authorized by the owner to intervene in all Construction affairs		
	2) Procurement	**2) Human performance**	**2) Human performance**
	2.1) The bidding resulted in a contract with appropriate price.	2.1) PMC persuaded other project stakeholders to develop a good team externally.	2.1) Project manager encouraged well his/her subordinators and treaded them fairly
	2.2) The appropriate contractor was selected through bidding.	2.2) PMC made a good team for the project internally?	2.2) Project manager's subordinators had sufficient authority.
	2.3) All tenderers were satisfied with the biddings.	2.3) Coordination and communication was the main duty of PMC in project.	2.3) Project manager coordinated and communicated the well.
	2.4) The bidding was performed	2.4) PMC didn't limit his responsibility to the technical aspects.	2.4) PC made a good team for the project internally.
		3) Organizing performance	**3) Organizing performance**
		3.1) PMC made a good coordination among contractors of the project.	3.1) PC had a good cooperation with other contractors of the project.
		3.2) PMC had a well-established management system.	3.2) PC allocated appropriate and enough resources to the project.
		3.3) PMC had a good cooperation with other relevant third parties.	3.3) Project manager had authority enough to make decision on the projects.
		3.4) PMC led well the different parties toward project objective.	3.4) PC had a good cooperation With other stakeholders of the projects
		4) Technical performance	**4) Technical performance**
		4.1) PMC administrated project contract well.	4.1) PC administrated project contract well.
		4.2) PMC controlled well project cost.	4.2) PC controlled well project cost.
		4.3) PMC controlled well project time.	4.3) PC controlled well project time.
		4.4) PMC acted well in civil activities.	4.4) PC acted well in civil activities.

Table 2. Project type.

Project	Quantity	%
Petrochemical	32	27.1
Oil refinery	19	16.1
Gas refinery	11	9.3
Gas pipeline	16	13.6
Power plant	12	10.2
Oil storage	12	10.2
Loading station	7	5.9
Oil pump house	9	7.6

Table 3. Education field of respondents.

Field	Quantity	%
Mechanic	28	23.7
Civil	23	19.5
Electrical	15	12.7
Others	52	39.7

Table 4. The age range of respondents.

Range	Quantity	%
30-35	47	39.8
35-40	27	22.9
Less than 30	19	16.1
More than 40	25	21.1

owner and success constructs is less than 2. After deleting its path, the model was built in Figure 1.

The desired values of RMSEA, P-value and chi-squire/df are designating that the built model fit the collected data well.

The value of R^2 in this model equals 0.935 which means that more than 95% of project success depends on these two factors and success can be guaranteed by focusing on them. Referring to correlation standard coefficients, consultant performance construct has a stronger correlation (0.54) with success than that of contractor performance (0.4).

Identification of active performance components on project

The performance components and constructs, active in project success were identified and verified in the previous section. Accordingly, the top management of projects should focus more on consultants and contractors performances than that of the owners.

The correlations of consultant and contractor performance constructs dimensions (4 dimensions for each one) with success were analyzed by structural modelling, to rank the various components of the two constructs based on their affect weights. The results of the analysis are shown in Figure 2.

In this model, also, the values of RMSEA, P-value and Chi-squire/df appeared acceptable. R^2 in this model equals 0.937 which means more than 90% of projects success initiates from these two factors.

Among the above mentioned 8 dimensions, technical and human dimensions of consultant performance construct and technical and organizational dimensions of contractor performance construct have the most influence on project success. The standard coefficients of this correlation show, also contractor technical and organizational dimensions have the most and the least influence on project success respectively. Technical and human dimensions of consultant performance construct with equal value are put the two extremes of contractor's dimensions.

Identification of active performance components on project

Accordingly, the most active constructs, components and dimensions on the project were identified. And, they can be used as a base of planning for success in performing future projects.

But to plan and prioritize these constructs, components and dimensions, another criterion is required and that is current state of those in Iran. It is obvious that if the current state is not satisfying, its modification is prioritized to keep the balance. To do that, it is required to compute the component deviation from ideal state by the Equation 1. The ideal scale has been considered to be equal to 5, since five-point Likert scale has been chosen for measurement in this research.

$$\mathrm{Gap}_i = 5 - \mathrm{Score}_i \quad (1)$$

With this approach, the above mentioned dimensions can be prioritized based on two criteria: the extent they affect the success of project (directly) and current state (indirectly). In this respect, one of the techniques of multi-criterion decision making is used. One of the most widely used techniques is Topsis which was invented by (Wang and Huang (2006). In this technique, m items are measured by n indicators and every problem can be considered as a geometric system including m points in an n dimensional space. The technique is based on the concept: having the least distance from selected item to the positive ideal solution (the best possible state, Ai^+) and the biggest distance from selected item to the negative ideal solution (the worst possible state, Ai^-). It is assumed that the desirability of each indicator is evenly increasing or decreasing. The results attained from

Table 5. Cronbach's alpha.

Item	Total	Success	Owner	Consultant	Contractor
α Coefficient	0.99	0.959	0.957	0.969	0.97

Table 6. Explanatory and confirmatory factor analysis.

Construct	Explained variance	KMO	Bartlet. Sig.	Min. communalities	Min. factor load	RMSEA	Chi-Square/df	df	Chi-Square	P-value
success	85%	0.915	0	0.82	0.907	0	0.934	5	4.67	0.456
owner	74%	0.947	0	0.649	0.806	0.063	1.46	23	33.56	0.071
Consultant	69%	0.968	0	0.62	0.787	0.045	1.24	88	109.24	0.0621
Contractor	69%	0.958	0	0.607	0.779	0.043	2.21	5	6.07	0.2992

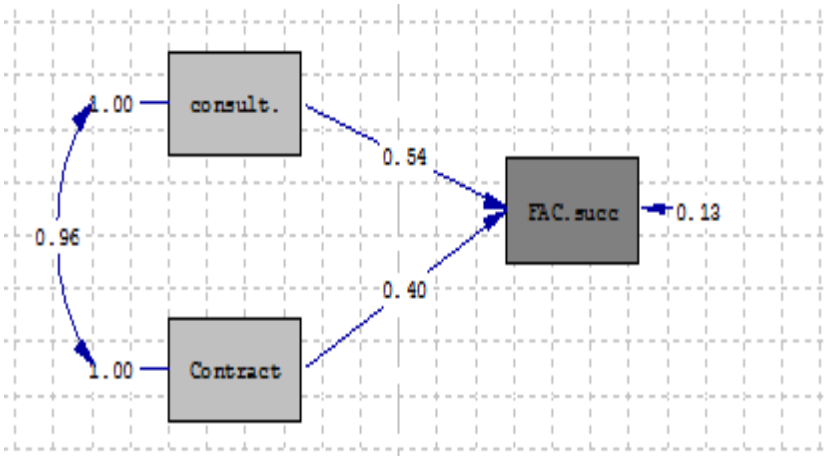

Figure 1. The relation between success and dimensions.

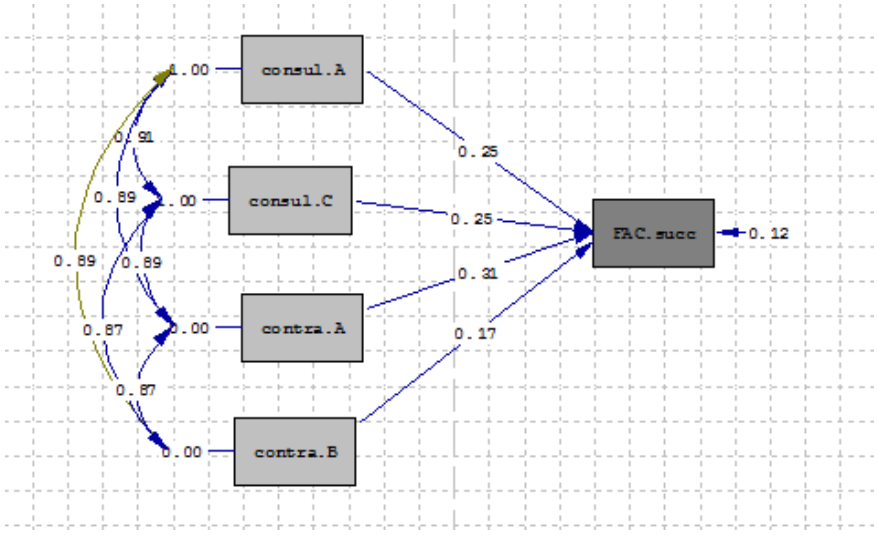

Figure 2. The relation between success and dimensions.

Table 7. TOPSIS results for ordering dimensions.

Dimension	Negative distance	Positive distance	Chi indicator	Rank
Contractor technical dimension	0.14	0	1	1
Consultant technical dimension	0.004	0.06	0.572	2
Consultant human dimension	0.08	0.06	0.57	3
Contractor organizational dimension	0.08	0.14	0.028	4

Topsis calculations for ranking dimensions are shown in Table 7.

DISCUSSION

As the research results show, project succes in iran is first heavily influinced by consultant performance. Maybe, the reason is that the owners are not, as expectd, provided with the experts comparing to consultant compamnies in vaious fields becouse consultants perform similar projets in other places and having experienced personels which is mandatory. So, as the owner decide to impliment his project, he hire a consulant company or companies to study, design and supervise the project. Accordingly, the owner make the consultant company the single point of responsibility. So, the owner role in performing the project can not be as manifest as the consultant.

While in china, as the results of the research, " The relationships between key stakeholders project performance and project success: Perceptions of Chinese construction supervising engineers" (Xiaojin and Jing, 2005), show that the owner has the main influence on project succes.

Also, as the research results and experiences show the role of the contractor can not be as important as consultant becouse, as it is mandatory, the consultant have more educated and experienced personels than the contructor and the owner make the contractor persuaded that the single responsible point of project is the consultant and he should listen his comments. So, it is not far from expectation that the consultant role has been considered to be more important than the contractor.

But, from another view, in the research results, technical aspect appears as the most important criterian determining the overall success rate of a project. Maybe, the reason is that the technical aspect is more observed than other aspects including human, organizing and integration. And, any strength or weakness in those latent aspects manifest in technical aspect while they have also the same importance. It is inreresting that in an research titled as "The relationships between key stakeholders project performance and project success: Perceptions of Chinese construction supervising engineers" (Jing et al., 2009), relation among the key project stakeholders appears as the most important criterion the determining the overall success rate of a project.

Conclusion

Some empirical evidences about perception of Iranian companies of project success, stake holder's project performance and project success have been provided by this research. According to the previous results, it can be concluded that:

Owners' project performance plays no role in determining project success, while that of consultants play the most important one.

Technical aspect of stake holder's performance has been used as the most important criterion of project success.

SUGGESTED FURTHER RESEARCH

Other researches can be carried out from different perspectives of strategic management approaches.

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