Journal of Construction in Developing Countries, 19(1), 35–52, 2014

Analysis of Project Failure Factors for Infrastructure Projects in Saudi Arabia: A Multivariate Approach

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Abstract: The rapidly changing face of the Saudi construction industry occasioned by the boost in oil revenue means that the best project management practices must be given priority to be able to confront the challenges associated with the management of infrastructure projects. The study develops a framework for identifying and classifying causes of project failures in the Saudi construction industry. A quantitative questionnaire survey was used to solicit responses from 67 respondents in the city of Jeddah, selected using an online questionnaire survey. Target respondents were mainly civil engineers, architects, quantity surveyors and building engineers who have years of experience in the management of infrastructure projects in Saudi Arabia. Findings reveal that poor risk management was rated the most critical failure factor for infrastructure projects, while budget overruns and poor communication by management followed closely at second and third, respectively. Additionally, eight components were extracted from the 24 items used for factor analysis. Among the extracted factors are project management deficiencies, risk challenges and government interference. Recommendations include, among others, that project risk management frameworks should be re-designed to guide clients and other stakeholders in an effort to reduce a project's unexpected exposure to risk.

Keywords: Factor analysis, Failure factors, Project management, Project delivery, Saudi Arabia

INTRODUCTION

The contribution of the Saudi Arabian construction industry to the growth of the Saudi economy has been unprecedented over the past three decades as a result of an increase in revenue from oil. According to Adhami (n.d.), the Saudi economy is increasingly becoming diversified, with construction and industry contributing 40% to the kingdom's gross domestic product (GDP), while infrastructure projects are earmarked to take a share of USD 140 billion out of USD 690 billion worth of Saudi development projects (SDP) for the period from 2006–2020. The evidence is almost uniformly consistent that these projects "fail" as a result of the combination of under-budgeting, cost and schedule overruns, improper scope and not meeting users' requirements. Hughes, Tippett and Thomas (2004) highlighted many reasons for such failures, including technological failures, inadequate project management implementation and a lack of communication. Other reasons include an unfamiliarity with the project scope and project complexity. The successful implementation of project management principles leads to project success in terms of time, cost, quality and user requirements.

Although various studies have largely identified several factors that may be associated with project success, relatively less coverage has been given to project failures, particularly from the point of view of the Saudi Arabian construction industry. This study attempts to fill this gap by developing a framework for identifying and classifying the causes of project failures in Saudi Arabia from the

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perspectives of clients, consultants and contractors. The classification of the factors will be achieved using factor analysis which will establish a causal structure underlying the failure factors. This will provide insight into the major causes of project failures from the perspective of all parties involved and by so doing, will test and validate existing statement or assertion that expresses a judgement or opinion about the concept of project failures in the context of Saudi Arabia's construction industry.

The aim of this study is to identify and classify the causes of project failures in the Saudi construction industry. The specific objectives are as follows:

1. To identify the critical failure factors affecting infrastructure project performance in Saudi Arabia;
2. To categorise these factors into a cluster of factors using factor analysis; and
3. To test the degree of agreement on the ranking of project failure factors.

The paper is structured into five sections. The first section above presented a brief background to the research problem. The next section presents a review of related existing literature to put the study in a proper perspective. This is followed by methodology, which details the measures and techniques adopted to achieve the stated objectives. This article will also discuss the analysis and results that emanated from the analysis, before presenting the conclusion and recommendations at the end of this discussion.

LITERATURE REVIEW

A Brief Overview of Saudi Arabian Construction Industry

The kingdom of Saudi Arabia enjoyed an economic boom during the 1980s when revenues from oil brought tremendous financial support for infrastructure development projects (Gulf Construction and Saudi Arabia Review, 1989). During that period, it was reported that two-thirds of all construction projects were awarded by the government and its agencies (Central Department of Statistics, 1994). However, when the price of oil fell during the period from 1986–1990, the resulting economic meltdown affected the industry. Consequently, many projects were either abandoned or re-negotiated with many contracts encountering payment problems and a lack of financial assistance and guarantees. Furthermore, according to Al-Sedairy (2001), as the emphasis by government shifted from complex construction projects to more basic building projects, concerns about technical expertise and joint venture partnerships between local and multinational companies began to come up, putting pressure on the Saudi private sector to become more involved in construction projects.

With unprecedented wealth coming from oil revenues in the last two decades and with over USD 300 billion in new projects, large-scale construction activities spreading from residential complexes to industrial clusters have continued apace as a result of the oil boom and have acted as a catalyst for the development of a non-oil sector (*Business Week*, 2007: 1). Central to this goal is the development of vibrant new urban cities with a business-friendly environment that leverage Saudi Arabia's competitive advantages of low cost energy and strategic location.

The construction boom is also boosted by the development of King Abdullah Economic City, which covers approximately 180 million square meters north of Jeddah and is comprised of an industrial zone, a central business district, a resort district, an educational zone, residential communities, and a seaport expected to be among the world's largest upon completion (*Business Week*, 2007: 17–18).

In summary, the Saudi construction industry is currently growing and adding to the country's GDP on a large scale. This trend will continue as long as the world continues to need oil.

Past Empirical Studies on Project Failures

Although Pinto and Mantel (1990) are of the view that it is difficult to define exactly what constitutes a failed project, the Project Management Book of Knowledge according to Project Management Institute (2004) posits that the success or failure of a project is measured by the difference between what is expected of a project both during and after its completion and the actual observed performance of the project when it is put to use. In other words, when the expectations of the client and other stakeholders in terms of cost, completion time and quality are not matched by the actual construction by contractors and other project teams, the project is adjudged a failure. The search for factors that can affect the success or failure of an infrastructure project has caught the attention of many scholars and construction practitioners over the years. This is because the ability to develop a set of project failure factors could aid the project team and contractors alike in evaluating their projects, if not objectively at least systematically. Several studies relevant to the identification of factors contributing to project failures for infrastructure projects are found in the literature. The following gives a summary of some of the studies to establish a theoretical framework for testing the theory empirically.

Project success has been defined as the degree to which goals and objectives of a project are met (Frederikslust, 1978). However, the inability of projects to meet these goals and objectives is project failure. A project is adjudged a failure when it fails to meet the tripartite criteria of time, budget and quality, even though recent studies have added such criteria as sustainability, stakeholder management, communication, and risk management issues.

Ogunlana, Promkuntong and Vithool (1996) identified three main categories of problems working against project success: problems of shortages or inadequacies in industry infrastructure, problems relating to clients and consultants, and challenges caused by contractor incompetence. These were all discovered to have significant impacts on project performance.

Kaming et al. (1997) investigated factors responsible for failure for 31 high-rise projects in Indonesia and discovered cost and time overruns are the most critical. However, cost overruns were more severe than time overruns. The study listed material cost increases due to inflation, inaccurate material estimation, and the degree of complexity as the major sub-factors driving cost overruns, while design changes, poor labour productivity, inadequate planning, and resource shortages drive time overruns.

Clough and Sears (2000) carried out a study that discovered the construction contracting business possesses the second highest failure rate of any business, exceeded only by restaurants. Additionally, compared with other industries, the client is made to bear a greater degree of financial risk for a longer period of time during the construction process, while the contractor is at far more risk than his counterpart in almost any other industry (Kangari, 1988). Although some companies that experience failure are small in regard to their owned assets, there is evidence of project failures among large firms, including construction companies (Sanvido et al., 1992). However, a number of studies have identified construction projects failures at the project level, rather than the company level. The general reasons adjudged for construction project failures have constantly been the same over a long period of time (Hall, 1982; Morris and Hough, 1987; Russel and Jaselski, 1992; Abidali and Harris, 1995). Contributions to construction industry failure include but are not exclusive to the following; lack of engineering skills, lack of a strong financial director, inadequate cash flow plan, poor budgetary control system and defective bidding system (Ebeid, 2009).

In a study of large construction projects in developing countries, Nguyen, Ogunlana and Lan (2004) organised the top ranking problems/failure factors into four major categories: incompetent designers and contractors, poor estimation and change management, social and technological issues, and improper techniques and tools.

Using the context of the Saudi Arabian construction industry, Assaf and Al-Hejji (2006) used a questionnaire survey to identify the major causes of delay from among 73 different causes of delay, using information gathered from clients, consultants and contractors in Saudi Arabia. The study discovered that change orders are the most common cause of delay and that 70% of the projects experienced time overruns.

In related research, Sambasivan and Soon (2007) identified 28 delay (project failure) factors and categorised them into client-related, contractor-related, consultant-related, material-related, labour and equipment-related, contract-related, and external factors. However, studies by Alaghbari et al. (2007) and Sweis et al. (2008) found that financial-related factors are some of the most critical factors that can trigger project failure in terms of delay. This is because incessant increases in construction cost by contractors during construction often lead to delays in payment and subsequent interruption of cash flow mechanisms, thereby subjecting sub-contractors and suppliers to financial difficulties, a panacea for project failure.

Toor and Ogunlana (2008) examined the problems causing delays and failures in major construction projects in Thailand using a questionnaire survey and interviews. Factors such as a lack of resources, poor contractor management, and a shortage of labour were the top rated. Other factors, such as design delays, planning and scheduling deficiencies, change orders and a contractor's financial difficulties were also significant, causing project failures in Thailand according to the study.

According to Ebeid (2009), a shortage of professional and adequately skilled personnel at all levels of management and field operations amongst clients, contractors and consultants in the construction industry was identified as a cause of project failures. The reported shortages in the supply of engineers, surveyors, equipment operators, and other skilled workers hamper the ability of project stakeholders to undertake large volumes of work with acceptable standards of quality workmanship (Datta, 2000; Materu, 2000; Belassi and Tukel, 1996).

Recently, the study by Kazaz, Ulubeyli and Tuncbilekli (2012) used a questionnaire survey to examine the causes and reasons for delays and failures in construction projects in Turkey. Out of 34 factors used for the survey, design and material changes, delay of payments and cash flow difficulties by contractors were found to be the three most significant factors.

Even though the intrinsic factors are largely perceived to be reasons for project delays and failures, it is apparent from the studies that there is relatively less coverage of factors contributing to project failures in Saudi Arabia. This study intends to contribute in this regard by addressing the knowledge gap. The next section describes the methodology used to conduct the research.

METHODOLOGY

The above literature review provides the theoretical basis for developing the research framework for this study. Taxonomy of 30 variables comprised of commonly cited project failure factors was extracted from the literature review (Ogunlana, Promkuntong and Vithool, 1996; Clough and Sears, 2000; Assaf and Al-Hejji, 2006; Sambasivan and Soon, 2007; Kazaz, Ulubeyli and Tuncbilekli, 2012). Although they do not represent a complete inventory of factors contributing to project management failures, they represent the most cited. A pilot study was conducted through interviews with academic and industry experts to improve the validity of the content of the questionnaire before a final list of 30 variables was adopted and used for the study.

The two-part written questionnaire was the main instrument of data collection. Part one sought general information about the personal characteristics of respondents, such as qualification profile, class of their organisations, and years of experience, amongst others. In part two, respondents were asked to rate how the 30 factors have contributed to past failures of infrastructure projects in Saudi Arabia using a scale from 1–5, where 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree. An average benchmark of 3 was used to identify the project failure factors from the 30 factors after analysis.

The online profiles of professional members of the Association of Project Managers in Saudi Arabia (APMSA) who were registered with LinkedIn were accessed and reviewed through the internet. Based upon the contents of each profile, a total of 678 email addresses were gathered and contact made via email with a request that they participate in the survey. While 209 people responded, 67 returned valid and usable questionnaires, representing a response rate of 32%. The target respondents were engineers, architects, quantity surveyors, and other professionals who have handled infrastructure projects in the country for clients, consultants and project contractors in Jeddah. A request was specifically sent from the association through Heriot Watt University for members of the association who possess experience working on major construction projects in the Saudi Arabian city of Jeddah. It is understood that the outcome represents the entire kingdom.

Data collected was analysed using both descriptive and inferential statistical tools. The descriptive tools used are percentages, tables, mean and standard deviation. In this study, principal factor extraction with varimax rotation was performed using SPSS on the 30 items of project failure factors for a sample of 67 responses. Relative importance index (RII) was used to rank the perception of relative importance attached to the identified project failure variables. It was computed (Enshassi, Mohamed and Abushaban, 2009) as:

$$RII = \sum W / A*N$$

where W is the weight awarded to each variable by the respondents and ranges from 1 to 5; A is the highest weight = 5; and N is the total number of respondents (67) in this study.

RESULTS AND DISCUSSION

Demographic Survey of Respondents

This section analyses the personal characteristics of 67 respondents who returned valid questionnaires for the study. The result of the analysis is presented in Table 1.

Table 1. Demographic Survey of Respondents

Variables	Category	Frequency	%
Professional qualification	Civil engineer	18	26.9
	Architect	19	28.4
	Quantity surveyor	19	28.4
	Building engineer	11	16.4
	Total	67	100
Type of projects	Government projects	37	55.2
	Commercial projects	30	44.9
	Total	67	100
Academic qualification	PhD	–	–
	MSc/MEng	21	31.3
	BSc/BEng	46	68.7
	Total	67	100
Years of experience	5–10	8	11.9
	10–20	35	52.2
	20–30	24	35.8
	Above 30	–	–
	Total	67	100
Type of organisation	Client	16	23.9
	Consultant	29	43.3
	Contractor	22	32.8
	Total	67	100

PhD = Doctorate degree; MSc = Master of Science degree; MBA = Masters in Business Administration; BSc = Bachelor of Science degree; MEng = Master's degree in Engineering; BEng = Bachelor's degree in Engineering

There were 18 civil engineers, 19 architects, 19 quantity surveyors, and 11 building engineers amongst the respondents. In terms of project types, 37 respondents have handled mostly government projects, while 30 have handled commercial projects. Of all the respondents, 67 have bachelor degrees or the equivalent, while 21 have master degrees or the equivalent. In terms of years of experience, 35 had a range of 10–20 years, 24 had 20–30 years, while only eight had 5–10 years. None of the respondents had above 30 years of experience. In terms of organisations where respondents practise their profession, 16 work for client organisations, 29 work for consultant agencies, while 22 work for contractors. The results indicate a reasonably good spread of respondents in terms of the natural groupings used for the study. Therefore, their views and opinions are deemed a reliable sample of the industry.

Preliminary Investigation

To ensure that the constructs for the study met the required standard for analysis, three tests were conducted. They are reliability, validity and normality checks. To demonstrate reliability of items in the questionnaire, Cronbach's alpha (α) was calculated to examine the internal consistency of the scales. According to Pallant (2004), a threshold of 0.7 is deemed sufficient for analysis. A Cronbach's alpha (α) of 0.704 for 30 items was computed, which is above the recommended threshold value of 0.7, confirming the reliability of the study constructs. Content validity ensures that contents or questions in the questionnaire measure the subject being investigated. It was carried out based on a thorough review of related literature and cross-examination of contents by two academic researchers and two PhD students. Their comments and consequent adjustments of the questionnaire contents ensured they had content validity. Finally, normality of the 30 variables was examined using tests for skewness and kurtosis. The observed values of skewness and kurtosis should be tested against the null hypothesis of zero because values of skewness and kurtosis are zero when a distribution is normal (Chan, Ho and Tam, 2001). The values were within the range of –2.575 to +2.575 ($p < 0.01$, two tailed test, see Table 2). They are therefore found to be reasonably normally distributed.

Identification of Project Failure Factors for Infrastructure Projects in Saudi Arabia

A list of 30 factors was adapted from the literature and subjected to the views of respondents. They were asked to rate their responses using a 5-point Likert scale: 1 = strongly disagree, 2 = disagree, 3 = somehow agree, 4 = agree and 5 = strongly agree. The outcome of the analysis from SPSS is shown in Table 2.

The result indicates that "poor risk management", with a mean index of 4.52, was ranked first. This is closely followed by "budget overrun", with a mean index of 4.49, as the second ranked factor, while "poor communication management", with a mean index of 4.45, was rated third. Analysis of the top 10 ranked factors shows that there was only a marginal difference in the importance attached to the factors relative to each other. For instance, there was a 90.4% importance rating attached to poor risk management, and 90.1% importance attached to budget overrun, which is a marginal difference in importance of only 0.3%.

Table 2. Result of Analysis for Project Failure Factors of Infrastructure Projects in SA

Variables	Min	Max	Mean	SD	Skewness	Kurtosis	Rank
CONOBJECTIV	1	5	3.07	0.91	0.098	–1.44	21
LAKOFTMWK	2	5	3.57	0.7	0.026	–0.179	10
INEXPEOFPM	1	5	3.27	0.83	–0.378	0.573	17
POORMOTIV	1	4	2.54	0.75	0.095	–0.263	23
LACKOFUSER	1	5	3.22	0.9	–0.592	0.013	18
BUDGOVERUN	4	5	4.49	0.5	0.031	–2.062	2
SCHEDELAYS	3	5	4.43	0.56	–0.27	–0.923	4
LACKOFRESUR	1	5	3.43	0.86	0.066	0.172	12
FREQCHANGE	1	5	3.43	0.82	–0.626	0.189	12
POORISKMGT	2	5	4.52	0.75	–1.66	2.544	1
LACKOFCLEA	2	5	3.28	0.71	0.553	0.425	16
INADEQSTRUC	2	5	3.85	0.91	–0.57	–0.311	9
POORCOMUN	2	5	4.45	0.68	–1.143	1.335	3
DISHONESTY	1	5	2.23	0.74	0.738	2	26
CORRUPTION	1	4	2.23	0.76	0.417	0.107	26
WROSELPT	1	5	3.4	1.01	–0.354	–0.507	14
LAKEFFCH	2	5	4.03	0.76	–0.695	0.681	8
GOVINTER	1	3	1.75	0.77	0.471	–1.136	29
IMPROPLAN	1	5	3.18	1.09	–0.588	–0.381	20
NATRDISAS	1	4	1.61	0.74	1.001	0.444	30
FALUMGEXP	1	5	2.72	0.99	–0.341	–0.483	22
INADMISMT	1	5	3.21	0.95	–0.104	–0.343	19
CULTETIISS	1	4	1.97	0.82	0.746	0.41	28
FRAUD	1	5	2.52	0.96	0.359	0	24
CASHFLDIF	2	5	4.24	0.61	–0.58	1.727	6
POORESTMP	3	5	4.29	0.55	0.026	–0.543	5
OVERREGL	1	4	2.33	0.66	0.829	0.746	25
SLUMECON	1	5	3.4	0.99	–0.21	–0.688	14
DESDESCRIP	2	5	4.24	0.65	–0.621	0.932	6
PORRQUALBR	1	5	3.45	1.01	–0.385	–0.441	11

Min = Minimum score; Max = Maximum score; SD = Standard deviation

Overall, 21 out of 30 factors used for the survey were determined to be critical in explaining the causes of project failure for infrastructure projects in Saudi Arabia by having scored a minimum benchmark of 3, which was designated as the average score. However, nine other factors scored below 3 and therefore did not meet the cut-off threshold. The five lowest scoring factors are dishonesty (2.23), corruption (2.23), cultural or ethical issues (1.97), government interference (1.75), and natural disasters (1.61).

Classification of Failure Factors Using Factor Analysis

The aim of this section is to use factor analysis to explore the underlying relationships within the 30 variables used for the study. Principal component analysis (PCA) for factor extraction was applied to categorise the project failure factors into fewer groupings.

However, prior to the analysis, preliminary checks were conducted to seek the suitability of the dataset for factor analysis. Two tests were conducted to test the strength of the relationships among the variables. They are Bartlett's test of sphericity (Bartlett, 1954) and the Kaiser-Meyer-Olkin (KMO) index (Kaiser, 1960). According to Ferguson and Cox (1993), Bartlett's test of sphericity ensures that the correlation matrix is an identity matrix while the KMO measure of sample adequacy should not be less than 0.5 for the data to be suitable for factor analysis.

The first trial using the 30 variables gave an unsatisfactory result. Although the correlation matrix was an identity matrix, it failed to meet the criteria for the KMO measure of sample adequacy (0.432 < 0.5). A close examination of the anti-image correlation result detected six factors whose KMO indices were less than 0.5. The six factors, namely "lack of teamwork among stakeholders", "inexperienced project manager", "frequent changes in user requirements", "a slump in the economy", "design discrepancies", and "poor quality briefing processes" were deleted from the data set before a new trial was conducted.

The second trial with 24 variables indicates that Bartlett's test of sphericity is 663.707, with a significance value of 0.000, confirming that the correlation matrix is an identity matrix. Additionally, the KMO measure of sample adequacy (0.556) was above the 0.5 threshold. The result of these tests confirmed the appropriateness of the revised variable dataset for factor analysis (see Table 3).

Table 3. Bartlett's Test and KMO for the Factors

KMO and Bartlett's Test		
KMO measure of sampling adequacy		0.556
Bartlett's test of sphericity	Approx. chi-square	663.707
	df	276
	Sig.	0.000

An 8-component model was extracted from 24 items of project failure factors for a sample of 67 responses. They accounted for 68.55% of the variance in responses, while all factor loadings were greater than 0.5. Eigenvalues, percentages of variance explained, and cumulative percentages for the eight extracted factors are shown in Table 4. Additionally, the component transformation matrix for the eight components, shown in Table 5, indicates that more than half of the correlation coefficients are above the recommended level of 0.3 (Norusis, 1993; Li et al., 2005; Yang et al., 2009). The loading of the extracted factors were therefore reasonably consistent.

Table 4. Result of Total Variance Explained for Project Failure Factors

Component	Initial Eigenvalues			Rotation Sums of Square Loadings		
	Total	% of Variance	Cumulative	Total	% of Variance	Cumulative
1	4.68	19.50	19.50	2.31	9.62	9.62
2	2.72	11.33	30.84	2.29	9.55	19.17
3	2.05	8.55	39.38	2.18	9.09	28.26
4	1.85	7.69	47.08	2.17	9.06	37.31
5	1.53	6.39	53.46	2.06	8.60	45.91
6	1.45	6.03	59.49	2.00	8.35	54.26
7	1.13	5.71	64.20	1.97	8.19	62.44
8	1.07	5.58	68.65	1.49	6.20	68.65

Extraction method: Principal Component Analysis

Table 5. Component Transformation Matrix for the Eight Extracted Components

Component Transformation Matrix									
Component		1	2	3	4	5	6	7	8
Dimension	1	.512	.191	.381	.436	.364	.450	.172	.042
	2	.370	.795	–.171	–.399	-.369	.095	.269	.442
	3	.464	.043	–.652	.014	.405	–.283	–.206	.566
	4	–.098	–.227	–.206	–.347	.299	–.542	.878	–.310
	5	–.364	.078	.307	.452	–.433	–.377	.195	.818
	6	–.054	.040	–.309	.801	–.394	–.196	.167	–.393
	7	–.487	.038	–.399	.125	.301	.667	–.775	.355
	8	–.467	.518	.094	.139	.557	–.284	–.112	–.487

Extraction method: Principal Component Analysis
Rotation method: Varimax with Kaiser Normalisation

Table 6. Result of Factor Analysis Showing the Factor Loadings

Variables	F1	F2	F3	F4	F5	F6	F7	F8
INADMISMT	0.727							
IMPROPLAN	0.595							
INADEQSTRUC	0.586							
POORESTMP		0.726						
POORISKMGT		0.631						
LACKOFRESUR	0.599							
NATRDISAS		0.542						
WROSELPT			0.809					

(continued on next page)

Table 6. (*continued*)

Variables	**F1**	**F2**	**F3**	**F4**	**F5**	**F6**	**F7**	**F8**
LAKEFFCH			0.789					
CONOBJECTTIV			0.571					
POORCOMUN			0.506					
CULTETIISS				0.754				
FRAUD				0.719				
CORRUPTION				0.522				
GOVINTER					0.814			
OVERREGL					0.527			
LACKOFCLEA						0.760		
DISHONESTY						0.585		
POORMOTIV						0.530		
CASHFLDIF							0.903	
BUDGOVERUN							0.843	
SCHEDELAYS							0.783	
LACKOFUSER								0.681
FALUMGEXP								0.813

Extraction method: Principal Component Analysis
Rotation method: Varimax Method with Kaiser Normalisation

The extracted factors are interpreted as follows:

1. FI: Project management deficiencies
   This factor consists of three items that focus mainly on failures that arises as a result of deficiencies in project management practices. Project management deficiencies include inadequate or misused methods, improper planning of projects from the onset, and inadequate project structure. The inability of involved stakeholders to use best practices and methods, to put into place a planning strategy for executing a project and to use an effective management structure for projects could be part of the cause of project failures in Saudi Arabia.

2. F2: Risk challenges
   This factor consists of three items. It emphasises the potential risk management issues that could have been omitted in the management of infrastructure projects. The items are poor estimation practices which could lead to outrageous claims, poor risk management, apparent lack of resources, and natural disasters.

3. F3: Project team commitment
   This factor consists of four items that focus on failures due to lack of teamwork and project participants' commitment to the project. It includes wrong selection of project team, lack of efficient change management, conflicting project objectives and poor communication management.

4. F4: Ethical issues
   This factor consists of three items. They are cultural or ethical issues which could lead to disaffection among stakeholders, delays and subsequent abandonment and failures. The three items are cultural and ethical issues, fraud and corruption.

5. F5: Government interference
   In this factor, there are two items concerning the overbearing interference of government agencies in the management of projects and perceived cases of deliberate over-regulation, which combine to have a damaging impact on the successful outcome of a project.

6. F6: Constraints imposed by stakeholders
   There are three items in this factor that examines whether perceived dishonesty among workers at the project site, poor motivation of workers by management and lack of clear directives to subordinates trigger project failures for infrastructure projects in Saudi Arabia.

7. F7: Financial and schedule challenges
   This factor consists of three items, including cash flow difficulties, budget overruns, and schedule delays. This factor contributes to project failures that arise as a result of excessive cost and time overruns as well as an inability of client to meet cash flow obligations.

8. F8: User requirement
   This factor consists of two items that focus on the changing needs of end-users. Specifically, it addresses project failures arising due to the inability of project stakeholders to obtain the input of users of projects when it is completed as well as a failure to manage the expectations of end-users.

Test of Agreement among Respondents

Spearman's rank correlation was used to examine the level of agreement amongst the three groups of respondents on the 30 project-failure factors in Saudi Arabia. Spearman's rank correlation is a non-parametric tool that does not require the assumption of normality in the population (Fadiya et al., 2012) and therefore is good for ranked items. The result of this analysis from SPSS at a 5% significant level (two-tailed) is shown in Table 7.

Table 7. Spearman Rank Correlation Coefficients Result

Group	Client/Contractor	Client/Consultant	Contractor/Consultant
β	0.862*	0.890*	0.781*

*Correlation is significant @ 5% significance level (two-tailed)
β- Spearman rank correlation coefficient for each group

The table shows the correlation coefficients for the three pairs of respondents, namely client/contractor, client/consultant, and contractor/consultant. The results of the statistical analysis indicate a general consensus on the rankings of the project failure factors among the groups, as all groups showed significant loadings of 86.2%, 89% and 78.1%, respectively, meaning they ranked the factors similarly.

Discussion of Findings

The 10 most highly ranked causes of project failure for infrastructure projects (based on all respondents), as shown in Table 2, were (1) poor risk management (mean = 4.52, RII = 0.904), (2) budget overruns (mean = 4.49, RII = 0.901), (3) poor communication management (mean = 4.45, RII = 0.889), (4) schedule delays (mean = 4.43, RII = 0.886), (5) poor estimation practices (mean = 4.29, RII = 0.859), (6) cash flow difficulties (mean = 4.24, RII = 0.848), (7) design discrepancies (mean = 4.24, RII = 0.848), (8) lack of efficient change management (mean = 4.03, RII = 0.806), (9) inadequate project structure (mean = 3.85, RII = 0.779), and (10) lack of teamwork (mean = 3.57, RII = 0.713).

Lack of efficient risk management and mitigation mechanisms for projects has been considered a critical failure factor by many researchers. As noted in the literature review, the Saudi Arabian construction industry is booming as a result of increased revenue from oil, but it will be a failure if clients and consultants do not pay enough attention to risk management for construction projects. This is because only projects that are well secured against risks have a greater likelihood of success. Budget overruns are known to cause project delays and failures. According to Sambasivan and Soon (2007), factors such as change orders, which occur as a result of changes in the deliverables and inconsistencies in contract requirements as well as mistakes and discrepancies in the interpretation of contract documents, can result in budget overruns. Poor communication management was ranked as the third most significant factor, which demonstrates that the communication between parties involved in the project (clients, consultants, contractors and sub-contractors) is crucial to the success or failure of the project. In other words, the failure to establish clear channels of communication between various parties is an invitation for chaos arising from severe misunderstandings and subsequent failure of infrastructure projects. Schedule delays, otherwise known as time overruns, ranked as the fourth highest factor and are considered critical to the failure of projects in Saudi Arabia. Inadequate planning by contractors and project managers, improper site management by contractors, inadequate experience handling projects, and delays in payments to contractors by clients are factors that result in schedule delays. Factor analysis of 24 of the 30 project failure factors resulted in eight extracted components, which were then renamed as project management deficiencies, risk challenges, project team commitment, ethical issues, government interference, constraints imposed by stakeholders, financial and schedule challenges and user requirements. This is consistent with previous studies (Al-Barak, 1993; Assaf and Al-Hejji, 2006; Sambasivan and Soon, 2007; Sweis et al., 2008; Doloi, Sawhney and Iyer, 2012). The result underscores the importance of the eight components of project failures in effectively delivering construction projects in Saudi Arabia. Specifically, issues of project team commitment, project management expertise in construction, and the role of external influences such as government interference were of concern to respondents.

The values of the Spearman rank correlation coefficient shows that there is relatively good agreement among pairs of respondents in the ranking of the project failure factors. The highest degree of agreement is 89% between clients and consultants while the least is 78.1% between contractors and consultants.

CONCLUSION

The aim of this study was to develop a framework for identifying and classifying causes of project failures in Saudi Arabia. The study employed a quantitative online survey method of research to elicit responses from 67 respondents who practice professionally as part of the construction industry in Jeddah, Saudi Arabia. Both descriptive and inferential statistical tools were used to analyse collected data. Spearman's rank correlation coefficient was used to examine the similarity or dissimilarity in the ranking of the project failure factors amongst the respondents, which were categorised into clients, consultants and contractors for the purpose of this study.

Twenty-one (21) out of the 30 factors used for the survey were found to be significant for explaining infrastructure project failure in Saudi Arabia. The following are the ten most highly ranked factors: (1) poor risk management, (2) budget overruns, (3) poor communication management, (4) schedule delays, (5) poor estimation practices, (6) cash flow difficulties, (7) design discrepancies, (8) lack of efficient change management, (9) inadequate project structure and (10) lack of teamwork. This result is based upon a benchmark of three points (out of five) used for analysis, which meant that all factors with a score of 3.0 and above were significant, while factors below 3.0 were not deemed significant enough to cause project failure by respondents. This satisfied objective one of the study and provides decision-making support for clients and other stakeholders by deepening the understanding of what constitutes the major failure factors, which could hinder project success both in the short and long term.

Based on the factor analysis approach, 24 of the 30 failure factors were further categorised into eight groups: (1) project management deficiencies, (2) risk challenges, (3) project team commitment, and (4) ethical issues, (5) government interference, (6) constraints imposed by stakeholders, (7) financial and schedule challenges and (8) user requirements. As a result of this analysis more is now known regarding what constitutes major categories of project failure factors.

The test of agreement that was carried out shows a strong level of agreement amongst various groups of respondents to the survey. It demonstrates the validity and reliability of information and findings from this research.

Information gathered from this research hope to benefit both practice and academics. In *practice*, the results can assist in the selection of project teams and their leaders for infrastructure projects in Saudi Arabia, can assist in the identification of potential points of failure so that appropriate standard remedial measures can be proactively taken and can also forecast expected performance level requirements even before the commencement of projects. In *academia*, the research has provided some insights and thoughts about existing theories pertaining to construction project management, particularly with regards to project success and failure and has the potential for being used to design or re-design the contents and curriculum of educational programmes for project managers and stakeholder management in construction.

RECOMMENDATIONS

The following recommendations are made based upon the findings of the study.

Project risk management frameworks should be put into place to guide clients and other stakeholders and to help predict the exposure of a project to unexpected risk. A way to do this is to commission experts to propose methods for the mitigation of risks at both the planning and execution stages, depending on the peculiarity of the project.

Contractors should manage their financial resource requirements and create cash flow plans for their projects through the use of progressive payment options. This would involve the hiring of highly experienced cost managers who should be able to advise on how to allocate financial resources based on progress of work completed to date. Clients, however, should fulfil their own part of payment obligations to contractors when due because not doing so can impair a contractor's ability to finance the next stage of project execution.

Communication management is one of the most recognised facilitators for project success. All stakeholders related to particular projects should be identified and clear channels of communication developed so that information regarding the project and topics that may likely breed acrimony can be solved amicably.

A recommendation is also made herein for further research. More research should be conducted to explore the inter-relationships between the eight components of project failure developed during this study. Studies can also be conducted to compare the outcome of this research in Saudi Arabia with that of other countries in the region as a way of strengthening the validity of the outcome. This is currently being explored as part of on-going research.

APPENDIX

List of Abbreviations

Variables	**Full Meaning**
CONOBJECTIV	Conflicting project objectives
LAKOFTMWK	Lack of teamwork among stakeholders

INEXPEOFPM	Inexperienced project manager
POORMOTIV	Poor motivation
LACKOFUSER	Lack of involvement of end users
BUDGOVERUN	Budget overrun
SCHEDELAYS	Project schedule delays
LACKOFRESUR	Lack of resources
FREQCHANGE	Frequent changes in user requirements
POORISKMGT	Poor risk management
LACKOFCLEA	Lack of clear direction and objectives
INADEQSTRUC	Inadequate project structure
POORCOMUN	Poor communication management
DISHONESTY	Dishonesty
CORRUPTION	Corruption
WROSELPT	Wrong selection of project team
LAKEFFCH	Lack of efficient change management
GOVINTER	Government interference
IMPROPLAN	Improper planning
FALUMGEXP	Failure to manage expectations
NATRDISAS	Natural disaster
INADMISMT	Inadequate or misused methods
CULTETIISS	Cultural or ethnic misalignment
FRAUD	Fraud
CASHFLDIF	Cash flow difficulties
POORESTMP	Poor estimation practices
OVERREGL	Over-regulation by government
SLUMECON	Slump in economy
DESDESCRIP	Design discrepancies
PORRQUALBR	Poor quality of briefing process

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