

Research Article

Causes of Contractors' Failure in Industrial Projects in Saudi Arabia

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Abstract: The study aims at identifying and assessing the main causes of contractors' failure in industrial projects in Saudi Arabia. 24 causes were identified from the literature for assessment by owners, contractors and subcontractors. These causes were classified under five categories, namely managerial causes, financial causes, growth causes, environmental causes and uncontrollable causes. A survey of 36 participants was conducted. Data was collected from 15 owners, 11 contractors and 10 subcontractors. The results indicated that lack of experience in the business field, war, poor project management, poor cost estimation, unavailability of stationed project leader at site, neglect and type of the contract are the most severe causes behind contractor's failure in construction projects. The rank correlation coefficient indicated that there is a high level of agreement among owners, contractors and subcontractors on the severity of the different failure causes. The research provides a severity of the ranking of the different causes of failure so that mitigation measures could be developed to avoid them or lessen their effects.

Keywords: Causes of failure, contractor's failure, industrial projects, owner, subcontractor, Saudi Arabia

INTRODUCTION

Saudi Arabia's industrial sector has grown in recent years due to the availability of energy sources at reasonable prices and the demands for industrial products in the world markets. This increase and the subsequent success of the industrial sector necessitated the establishment of industrial plants to produce these products. This situation has derived a huge demand for a wide range of construction projects. Construction contractors in the industrial sector are playing an important role in pushing the growth upward by the successful delivery of industrial projects. Failure in delivering such projects will impact the growth rate of the sector. Therefore, it is important to understand and evaluate the causes of contractors' failure.

The construction industry has unique characteristics that sharply distinguish it from other sectors of the economy. It is fragmented, very sensitive to the economic cycles and political environment and has a significantly high rate of business failure. Moreover, the relative ease of entry gives rise to a large number of contracting firms competing intensely in the market exposing many of them to business failure (Enshassi *et al.*, 2006).

Construction work needs a high coordination and follow-up efforts without which projects could fail. In any project execution, the three triangle's segments;

owner, contractor and subcontractor are the main parties involved. It is not unusual that the interest of each party is conflicting with that of the other's. This is basically because of the different goals and objectives of each party. Quality, cost and time is the other triangle upon which different targets of each party are defined. The objectives of this study are to identify and assess the main causes of contractors' failure in industrial projects in Saudi Arabia. This research is of benefit to owners, contractors and subcontractors involved in industrial projects. The research provides a severity of the ranking of the different causes of failure so that mitigation measures could be developed to avoid them or lessen their effects.

RESEARCH METHODOLOGY

The authors have carried out the following research activities:

- Conducted interviews with a selected group of contractors and subcontractors and reviewed published international literature on causes of contractors' failure. 24 causes were identified for assessment by owners, contractors and subcontractors. These causes were grouped under five major categories. These categories are managerial, financial, growth, environmental and uncontrollable causes.

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- Developed a questionnaire survey that was distributed to owners, contractors and subcontractors for the purpose of assessing the severity of the identified causes of failure. Data was collected from 15 owners, 11 contractors and 10 subcontractors. This study is limited to industrial petrochemical projects with capital cost over 1 billion SR in the Eastern Province of Saudi Arabia.
- Developed conclusions and recommendations based on the results obtained from the analyzing the questionnaire survey.

PREVIOUS STUDIES

Failure in construction business is among the highest failure rates in business. There are many definitions of business failure. According to Dun and Bradstreet Corporation (1986), a business failure is defined as a business that ceases operation following assignment or bankruptcy; ceases operation with losses to creditors after such actions as foreclosure or attachment; voluntarily withdraws, leaving unpaid debts; and is involved in court actions such as receivership, reorganization of arrangement or voluntarily comprising with creditors.

Kangari (1988) investigated the effects of the economic factors, including the “amount of construction activity”, “loan interest rates” and “the number of new businesses entering construction” on the business failure in the construction industry. The study also developed a forecasting model to predict these failures so as to avoid them or lower the chances of their occurrences. The author suggested that construction companies should not only look at total failure, but at their level of success in terms of achieving the set profit margin.

Schleifer (1990) identified ten risky activities that could lead to contractors’ failure. Five of these activities are business strategies and the other five are fiscal or accounting considerations. These ten risky activities are “increasing project size”, “expanding into an unfamiliar location”, “moving into new types of construction and between public/private sectors”, “replacing key personnel”, “not maturing in management as business expands”, “using poor accounting systems”, “evaluating project profits incorrectly or not in time”, “not controlling equipment costs”, “not billing and collecting effectively” and “jumping between or upgrading computerized accounting systems”.

Russell and Jaselskis (1992) developed a model for predicting contractor failure prior to contract award. Two questionnaires were developed for data collection. The first questionnaire was administered to 85 organizations who were involved in 47 contractor

failures. The second survey was administered to 40 organizations out of the previously surveyed 885 organizations, who had 23 contractor failures. The study concluded that four variables could be considered as strong predictors for failures. These are “the amount of owner-contractor evaluation”, “whether cost monitoring was performed by the owner”, “the level of support received by the project manager from the contractor’s senior management throughout the course of the project” and “the early involvement of the contractor’s project manager”.

Jannadi (1997) interviewed accountants and contractors to identify the major factors that could contribute to the failure of construction contractors in Saudi Arabia. The study concluded that the most important factors are “difficulty in winning bids”, “poor judgment”, “inexperience in the company’s line of business” and “cash flow problems”.

Arditi *et al.* (2000) indicated that budgetary and macroeconomic conditions are major causes for contractors’ failure. The study concluded that strict budgetary and administrative control and prompt reaction to economic conditions would lessen the probability of contractors’ failure.

Davidson and Maguire (2003) concluded that based on certified public accounts and sureties of failed construction companies, the most common causes of construction contractor failure are “growing too fast”, “obtaining work in a new geographic region”, “dramatic increase in single job size”, “obtaining new types of work”, “high employee turnover”, “inadequate capitalization”, “poor estimating, accounting systems and cash flow management”, “buying dumb stuff”.

Schaufelberger (2003) identified four external factors and eleven internal problems that could potentially cause subcontractors’ business failure. The study surveyed a group of seventeen individuals, including five bonding agents, five construction accountants, two construction bankers and five owners of construction firms to classify the identified causes of subcontractors’ business failure into either “common cause”, “occasional cause” or “uncommon causes” for three different size firms. The study concluded that the subcontractor’s delayed cash receipts is a major cause of failure for small firms, but not mid-size or large firms. The study also indicated that large debts to company’s capital are the primary cause for failure for all firms. Increase of project size would be overwhelming to small subcontractors as it would result in business failure. Moreover, the study recommended several strategies for mid-size and large companies to avert business failure.

Strischek and McIntyre (2008) surveyed the literature on the major causes of contractors’ failure from the perspective of the surety industry. Four major causes of contractors’ failure were identified these

causes are financial, management, overexpansion and other uncontrollable factors. The study concluded that banks and sureties should be aware of these causes of failure so as to avoid the losses they might incur due to contractors' failure.

Kivrak and Arslan (2008) identified the contractors' causes of failure and surveyed 40 small-medium sized companies through personal interviews for the purpose of raking the importance of the identified causes of contractors' failure. The study concluded that lack of business experiences and country's economic conditions are the most important causes of construction company's failure.

Strischek and McLaughlin (2008) identified three categories of contractors' failure causes. These are strategic causes, organizational causes and uncontrollable causes. The strategic causes include "unrealistic growth, "overexpansion", "unfamiliar new markets, or entry into new types of construction", "volume obsession", "unrealistic promises" and "bad contracts, or poor project selection". The organizational causes include "insufficient capital or profits", "lack of business knowledge", "poor financial management", "poor sales skills, or inadequate marketing" and "poor leadership". The uncontrollable causes include "industry or economic weakness" and "banking and surety changes".

Mahamid (2012) identified 44 factors that could cause contractors' failure and classified them under three categories, including financial, managerial and external. The study then surveyed 84 contractors to assess the level of importance of the identified causes of contractor's failure from the contractor's perspective in the West Bank, Palestine. The findings indicated that the top factors are material cost, delay in payments by clients, lack of knowledge in contracts, low profit margin and movement restriction of people and product within the West Bank.

Based on the above cited studies and interviews with a selected group of contractors and subcontractors, 24 causes were identified for assessment by owners, contractors and subcontractors. These causes were grouped under five major categories. These categories are managerial, financial, overexpansion/growth, environmental and uncontrollable causes. These causes were then assessed through a questionnaire survey that was distributed to owners, contractors and subcontractors for the purpose of assessing the severity of the identified causes of failure.

SURVEY OF CONSTRUCTION CONTRACTORS' CAUSES OF FAILURE

Design of questionnaire survey: A questionnaire survey was developed to assess the severity of each of the identified 24 causes of contractors' failure in Saudi Arabia. The questionnaire carries both the instructions and questions to respondents and provides an enough

space for respondents to write down any comments or remarks. The authors considered both the subject content and the wording of each question in terms of shared vocabulary and clarity. Each question is stated in a way as to be as precise, short, simple as possible. There are three main parts in the questionnaire:

- **Part I:** An introduction to explain the purpose of the survey and its goals.
- **Part II:** this part included a listing of the identified 24 causes of contractors' failure in industrial projects. The contractor's causes of failure are divided into five groups namely; managerial causes, financial causes, expansion causes, environmental causes and other uncontrollable causes. For each question, the respondents having five options as follows: "Very influential", "Influential", "Slightly influence", "Not influential" and "Cannot decide".

Profile of the respondents: Data was collected from 15 owners of petrochemical plants out of a total of 25 owners, 11 Engineering, Procurement and Construction (EPC) contractors out of a total of 18 and 10 subcontractors of out 19. Table 1 presents the respondents' information summary. This study is limited to industrial petrochemical projects with capital cost over 1 billion SR in the Eastern Province of Saudi Arabia.

Scoring: Respondents to the questionnaire survey were requested to rate the influence severity of each cause of contractor failure using five-level Likert scale, namely "Extremely Influential", "Very Influential", "Influential", "Slightly Influential" and "Not Influential". A Severity Index (SI) was calculated for each cause using the following formula (Assaf and Al-Hejji, 2006):

$$SIC_N = \frac{100X_1 + 75X_2 + 50X_3 + 25X_4 + 0X_5}{X_1 + X_2 + X_3 + X_4 + X_5}$$

where,

SI : Severity index (C denotes cause and N is the number of the cause)

X1 : Number of respondents opting for "Extremely Influential"

X2 : Number of respondents opting for "Very Influential"

Table 1: Respondents' information summary

Respondents	Sample size	Responses	Percentage of respondents
Owners	25	15	60%
EPC contractors	18	11	61%
Sub contractors	19	10	53%
Total	62	36	58%

Table 2: Weighted influence severity

Extremity	Assigned weight
Extremely influential	100%
Very influential	75%
Influential	50%
Slightly influential	25%
Not influential	0

- X3: Number of respondents opting for “Influential”
- X4: Number of respondents opting for “Slightly Influential”
- X5: Number of respondents opting for “Not Influential”

The ordinal scale is used in this rating scheme with regular intervals. A weigh was assigned for each interval, ranging from “Extremely Influential” to “Not Influential” as shown in Table 2.

ANALYSIS AND DISCUSSION

Table 3 presents the severity indexes and the ranking of the different causes of failure by the owners, EPC contractors and Subcontractors. Table 4 presents the ranking of the contractors’ causes of failure as agreed by the combined sample of 15 owners, 11 EPC contractors and 10 subcontractors.

Assessment of causes of contractors’ failure by owners: The most influential causes of contractors’

failure as perceived by owners in a descending order are lack of contractor experience in business, war, poor project management, poor cost estimation and neglect. The authors are in agreement with these results as industrial projects require the involvement of experienced personal in the line of work. Contractors lack the required experience would face difficulties in executing the work as required by owners, especially in industrial projects. War is considered a highly disruptive factor to contractors as it results in heavy financial losses due the fact that war or acts of war are not usually covered by insurance companies. Project management is a fundamental skill needed to accomplish projects on time, cost and quality. Owners have the objective of completing their projects within these three constraints. Poor cost estimates, especially in competitively lump sum contracts could cause contractors to substantial amount of money and in extreme cases bankruptcy. Neglect which implies the contractor carelessness in responding to the contract terms and conditions and the need to accomplish certain aspects of the work could result in financial losses to the contractor.

Assessment of causes of contractors’ failure by EPC contractors: The results indicate that the most influential causes of contractors’ failure from the perspective of EPC contractors are similar to those as

Table 3: Severity indexes and ranks of project failure causes

Failure causes	Owners		EPC Contractors		Subcontractors		
	Severity index	Rank	Severity index	Rank	Severity index	Rank	
Managerial causes							
01.	Lack of contractor experience in business	90	1	89	1	90	1
02.	Change in owner or key personal	73	10	66	12	73	10
03.	Stationed project leader at jobsite	82	7	70	7	85	4
04.	Poor project management	88	3	75	4	90	2
05.	Company organization	48	22	61	18	53	19
06.	Neglect	85	5	68	8	80	8
Financial causes							
01.	Low margin profit due to competition	63	16	75	5	68	13
02.	Lack of capital	78	8	68	9	73	11
03.	Cash flow mismanagement	73	11	64	15	88	3
04.	Poor cost estimation	87	4	75	6	83	5
05.	Employee benefits and compensation	52	20	64	16	53	20
06.	Controlling equipment cost and usage	70	12	52	20	63	18
Overexpansion/Growth causes							
01.	Lack of project management maturity	83	6	82	3	68	14
02.	Diversification	67	14	48	21	53	21
03.	Increased number and size projects	63	17	66	13	68	15
04.	Opening regional office	52	21	66	14	68	16
Environmental causes							
01.	Construction industry regulation in Saudi Arabia	47	23	64	17	53	22
02.	Owner involvement in construction phase	62	18	43	22	50	23
03.	Bad weather	58	19	59	19	70	12
Uncontrollable causes							
01.	War	90	2	86	2	83	6
02.	Frame agreement with suppliers	68	13	43	23	65	17
03.	Bank polices	47	24	43	24	48	24
04.	Type of contract	75	9	68	10	83	7
05.	Delay in progress payment	67	15	68	11	80	9

Table 4: The ranking of the causes of failure as agreed by the combined sample of owners, EPC contractors and subcontractors

Rank	Causes	Severity index
1	Lack of contractor experience in business	90
2	War	86
3	Poor project management	84
4	Poor cost estimation	82
5	Stationed project leader at jobsite	79
6	Neglect	78
7	Lack of project management maturity	78
8	Type of contract	75
9	Cash flow mismanagement	75
10	Lack of capital	73
11	Delay in progress payment	72
12	Change in owner or key personal	71
13	Low profit margin due to competition	69
14	Increased number and size projects	66
15	Bad weather	62
16	Opening regional office	62
17	Controlling equipment cost and usage	62
18	Frame agreement with suppliers	59
19	Employee benefits and compensation	56
20	Diversification	56
21	Construction industry regulation in Saudi Arabia	55
22	Company organization	54
23	Owner involvement in construction phase	52
24	Bank polices	46

perceived by owners in terms of lack of contractor experience in business and poor project management. Moreover, EPC contractors rate low profit margin due to competition and lack of project management maturity as highly influential causes for the contractors' failure. Low profit margin due to competition could force EPC contractors to submitting low bids to be awarded contracts. This results in earning low profits which would ultimately affect their business activities. Maturity requires the careful consideration of the issues that surrounds the construction environment and making decisions based on a thorough analysis of the faced situation.

Assessment of causes of contractors' failure by subcontractors: The results also indicate that the most influential causes of contractors' failure from the perspective of subcontractors are similar to those as perceived by both owners and EPC contractors in terms of the three causes mentioned above, namely lack of contractor experience in business, poor project management, poor cost estimating practices. Further, subcontractors view that stationed project leader at the jobsite and cash flow mismanagement are highly influential causes for the contractors' failure. The availability of highly skilled project leader who has the right attitude, knowledge and experience is of a paramount importance to the success of the project as the project leader provides leadership for accomplishing the project on time, cost and quality. The project leader needs to be communicating to all the stakeholders in the project. Cash flow is of an extreme importance to the

contractor as the contractor could be handling projects worth hundreds of millions of dollars while his company assets could be worth few million dollars. Therefore, cash flow management is of extreme importance to the contractors so to be able to compensate all parties contributing to the construction project, especially subcontractors, material supplier and his own staff.

TEST OF AGREEMENT BETWEEN OWNERS, EPC CONTRACTORS AND SUBCONTRACTORS

The degree of agreement among the respondents; owner, EPC and subcontractor was tested using the technique of "The Rank-Order Coefficient of Correlation" as shown in the following formula:

$$\rho = 1 - \frac{6 \sum D^2}{N(N^2 - 1)}$$

where,

ρ : Is the rank order coefficient of correlation

$\sum D^2$: Is the sum of the squared differences in ranks of the paired values

N : Is the number of parameters for which the ranking is made (24 causes in this study)

It should be noted that the formula for ρ includes $\frac{6\sum D^2}{N(N^2 - 1)}$ term, which is subtracted from 1. If the factors were ranked in the same order, there would be no differences in the ranks and the sum of the differences squared ($\sum D^2$) would be zero. Thus ρ would equal (1-0) a perfect positive correlation. As the differences between the ranks orders of these causes increases, there would be an increased amount subtracted from 1 to reduce the correlation coefficient. In Summary, the higher value of, ρ the higher degree of agreement between parties involved in the calculations. Since the method is measuring the degree of agreement between two inputs together only, the test of agreement is conducted on three stages:

- **Case A:** Between Owners and EPC contractors. ρ is computed to be 0.763478.
- **Case B:** Between EPC contractors and Subcontractors. ρ is computed to be 0.773913.
- **Case C:** Between Owners and Subcontractor. ρ is computed to be 0.810435.

The results show that the value of ρ is relatively high. This means that there exists a general agreement between the parties involved in each case on the ranking of the influence severity of the causes of contractors' failure. The observed general level agreement on the severity of the causes of contractors' failure stems from the strong relationship between parties in the business. They are tied together either

contractually or via communication process in direct or indirect ways. Therefore, they are familiar, to a large extent, with the factors that could hinder the progress of the project or even could cause the project to fail.

CONCLUSION

Based on the overall assessment and ranking of causes by the combined sample of owners, EPC contractors and subcontractors, the following set of findings could be concluded:

- Lack of contractor experience in industrial projects was ranked as the top cause of contractor failure by all three parties, namely owners, EPC contractors and subcontractors. Industrial projects are characterized by extensive and complex set of activities, including planning, design, construction and commissioning and hand over. This wide range of activities requires the contractor to possess the necessary skills to complete such projects.
- War and acts of war was ranked the second among all causes of contractors' failure by the combined sample. The authors attribute the high rating of this factor to the destructive nature of war and acts of war. Although this is a cause of concern worldwide, this is of special concerns to all involved parties in the construction industry in the Gulf region due to the recent conflicts in the Gulf region in the past two decades.
- Poor project management is a significant source of failure in industrial projects. Project management as per the Project Management Institute (2008) includes the management of scope, time, cost, quality, risk, communication, procurement and human resources. Effective project management is a necessary background for completing project within the proceeding management areas. Any deficiency in any of these areas will affect the delivery of a successful project. This would ultimately affect the performance of the contractor as it might lead of the failure of the business.
- Cost estimating practices are critical to the contractors' success. Submitting high bids especially in competitive projects would result in the contractor' not getting any contracts. On the other hand, submitting low bids will result in losses to the contractor. This is especially the case in industrial projects which is characterized by high competition for projects costing hundreds of millions and in some cases billions of dollars.
- The study shows that availability of a stationed project leader at the site is of a paramount importance for the success of the project. The stationed project leader is a focal point for communicating with all project stakeholders for overcoming any site challenges and difficulties. Large contractors need to assign high skilled

project leaders in quantitative and qualitative manners to ensure the smooth flow of operations at the jobsite. Selecting an inappropriate project leader could negatively affect the delivery of the project, which would cause the contractor to fail.

- Neglect is another serious reason that could lead to failure in delivering the project. Neglect by the contractor could cause the owner to lose confidence in the contractor's quality of work and would entail the contractor to carry out some re-work in activities that he has already accomplished. Contractor's neglect of his own work would result in losses. Therefore, neglect could cause the contractors' business to fail.
- The type of the contract is another factor that needs to be looked at seriously. Each type of contracts has its own inherent risks, both to the owner and the contractor. While owners normally prefer lump sum fixed price contracts due to the transfer of most risks to the contractor, it might result in a poor quality of work. The reimbursable contract provides for payment by the owner for all direct and indirect costs and as such contractors would assume small risks. Industrial construction is mostly delivered through lump sum fixed price contract, which puts the contractor in high risks and would ultimately might lead to failure unless the contractor manage the project effectively.
- Poor cash management and lack of capital are adversary factors that could result in the contractors' failure. Contractors always obtain construction loans from a lending institution to be able to provide payments to all parties on certain times. However, these loans have to be paid back with high interest. Mismanagement of cash flow by the contractor would result in substantial payments made to lending institutions. Moreover, delays in payments to the subcontractors, material supplier would delay the project. These practices of poor cash management and lack of capital will ultimately lead to the contractors' failure.

RECOMMENDATIONS

Based on the findings of the study, the authors recommend the following:

- Contractors should improve the practices of calculating the project cost. They should get a clear idea of the scope of work included and perform a rigid take off of the quantities before concluding the bid cost and consider the administrative and project overhead costs, contingency and profit margin in their estimate.
- Contractor should appreciate the importance of having skilful project leader stationed at jobsite throughout the project. This is considered to be a

key factor in successful delivery of the project. The leader should be highly skilled and experienced to deal with the owner.

- Contractor should not neglect any of the owner requests. Instead, contractor should evaluate all requests and instructions and discuss with owner the extent or impact of such instructions. This will build a trustful ground between the owner and the contractor during the project life cycle.
- It is recommended that contractor should evaluate risk involved with each type of contract before entering into a contractual agreement with the owner. Advantages and disadvantages of each type of contract should be assessed and reflected on the contractor's in-house capabilities and financial situation. It is recommended that contractor should not proceed with any type of contract without considering the risk involved and the risk management plan to deal with it.
- Cash management is an important area that every contractor should thoroughly consider for better project management. It is recommended that contractors used information systems to manage the cash flow effectively and analyze the investments' opportunities.
- The contractor should exert all efforts to be reimbursed when progress payments are due. This could be realized by agreement with the owner in the contract provisions of the project.
- It is recommended that owners should instill a prequalification system to prequalify contractors. The prequalification system should include the technical, managerial and financial capabilities of the contractor.

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REFERENCES

- Arditi, D., A. Koksall and S. Kale, 2000. Business failure in the construction industry. *Eng. Constr. Archit. Manage.*, 7(2): 120-132.
- Assaf, S. and S. Al-Hejji, 2006. Causes of delay in large construction projects. *Int. J. Proj. Manag.*, 24(4): 349-357.
- Davidson, R.A. and M.G. Maguire, 2003. Ten most common causes of construction contractor failures. *J. Constr. Account. Tax.*, 13(1): 35-37.
- Dun and Bradstreet Corporation, 1986. *Dun's Census of American Business*. Dun and Bradstreet Corporation, New York, USA.
- Enshassi, A., K. Al-Hallaq and S. Mohamed, 2006. Causes of contractor's business failure in developing countries: The case of Palestine. *J. Constr. Dev. Countries*, 11(2): 1-14.
- Jannadi, M.O., 1997. Reasons for construction business failure in Saudi Arabia. *Proj. Manage. J.*, 28(2): 32-36.
- Kangari, R., 1988. Business failure in construction industry. *J. Constr. Eng. M-ASCE*, 114(2): 172-190.
- Kivrak, S. and G. Arslan, 2008. Factors causing construction company failure. *Proceeding of the Building Abroad Conference: Procurement of Construction and Reconstruction Projects in the International Context*. Montreal, Canada, October 23-25, pp: 297-306.
- Mahamid, I., 2012. Factors affecting contractor's business failure: Contractors' perspective. *Eng. Constr. Archit. Manage.*, 19(3): 269-285.
- Project Management Institute, 2008. *A Guide to the Project Management Body of Knowledge (PMBOK Guide)*. 4th Edn., ISBN 978-1-933890-51-7.
- Russell, J.S. and E.J. Jaselskis, 1992. Predicting construction contractor failure prior to contract award. *J. Constr. Eng. M-ASCE*, 118(4): 791-811.
- Schaufelberger, J.E., 2003. Causes of subcontractor business failure and strategies to prevent failure. *Proceeding of the Construction Research Congress: Wind of Change-Integration and Innovation*. American Society of Civil Engineers, Honolulu, Hawaii, United States, March 19-21, pp: 7.
- Schleifer, T.C., 1990. *Construction Contractor's Survival Guide*. Wiley Interscience, USA.
- Strischeck, D. and K. McLaughlin, 2008. Why do contractors really go under? A construction industry consultant looked for the real reasons behind contractor failures and found some surprising results. *RMA J.*, 91(2): 68-72.
- Strischeck, D. and M. McIntyre, 2008. Red flags & warning signs of contractor failure. *RMA J.*, 90(6): 72-77.