

# Study on Effect of Escalation on Construction Projects

<sup>1</sup>Mr.Rahul S.Chaudhari, <sup>2</sup>Dr. Sandip T. Mali

<sup>1</sup> Assistant Professor, <sup>2</sup>Head of Department

<sup>1</sup> Civil Engineering Department

<sup>1</sup> Pimpri Chinchwad College of Engineering, Nigdi, Pune.

**ABSTRACT:** Infrastructure remains a top priority for addressing developmental gaps as it is considered omnipotent with potentials of lifting economies out of the financial turmoil. The governments around the world are pumping money to generate demands for goods and services by creating jobs through higher spending into physical and social infrastructure. World construction industry is one of the biggest industries in the whole world. The contribution of this industry towards the global GDP revolves around one-tenth of the total amount. Global construction market to grow \$8 trillion by 2030: driven by China, US and India. In this study literature review was carried out to understand the scenario of cost escalation and inflation on the construction industry. For this regard, literature published in various countries was studied and summarized. Outcome of this study is to highlight the majors factors affecting cost escalation for construction projects all over the construction industry in developed and developing countries.

**Key word:** - Escalation, inflation, construction industry, cost overrun.

## I. INTRODUCTION :-

According to Global Construction Perspectives and Oxford Economics, forecasts the volume of construction output will grow by 85% to \$15.5 trillion worldwide by 2030, with three countries – China, US and India – leading the way and accounting for 57% of all global growth. The construction market in India will grow almost twice as fast as China to 2030, providing a new engine of global growth in emerging markets. India's urban population is expected to grow by a staggering 165 million by 2030. Construction is likely to be one of the most dynamic industrial sectors in the next fifteen years and is utterly crucial to the evolution of prosperous societies around the world. [ [Global Construction 29-30](#) ]

International construction market survey reflects this position with construction markets heating up as global conditions improve. Global construction cost inflation for 2016 was recorded at 3.7 percent, compared to 2.9 percent in 2015 for 2017 it was 3.5% [ [International construction market survey 2017](#) ]

In this paper details regarding effect of escalation/inflation on the construction market is discusses. The survey work done in various countries like Nigeria, USA, Zambia, china, India, UAE, Turkey and Pakistan are summarized. The effect of the escalation causes overrun of the project and also point of conflict between client and contractors. In most of the cases the Survey was carried out by personal interviews, circulation of questionnaire, and personal interaction with Client, contractor, Consultant & architect.

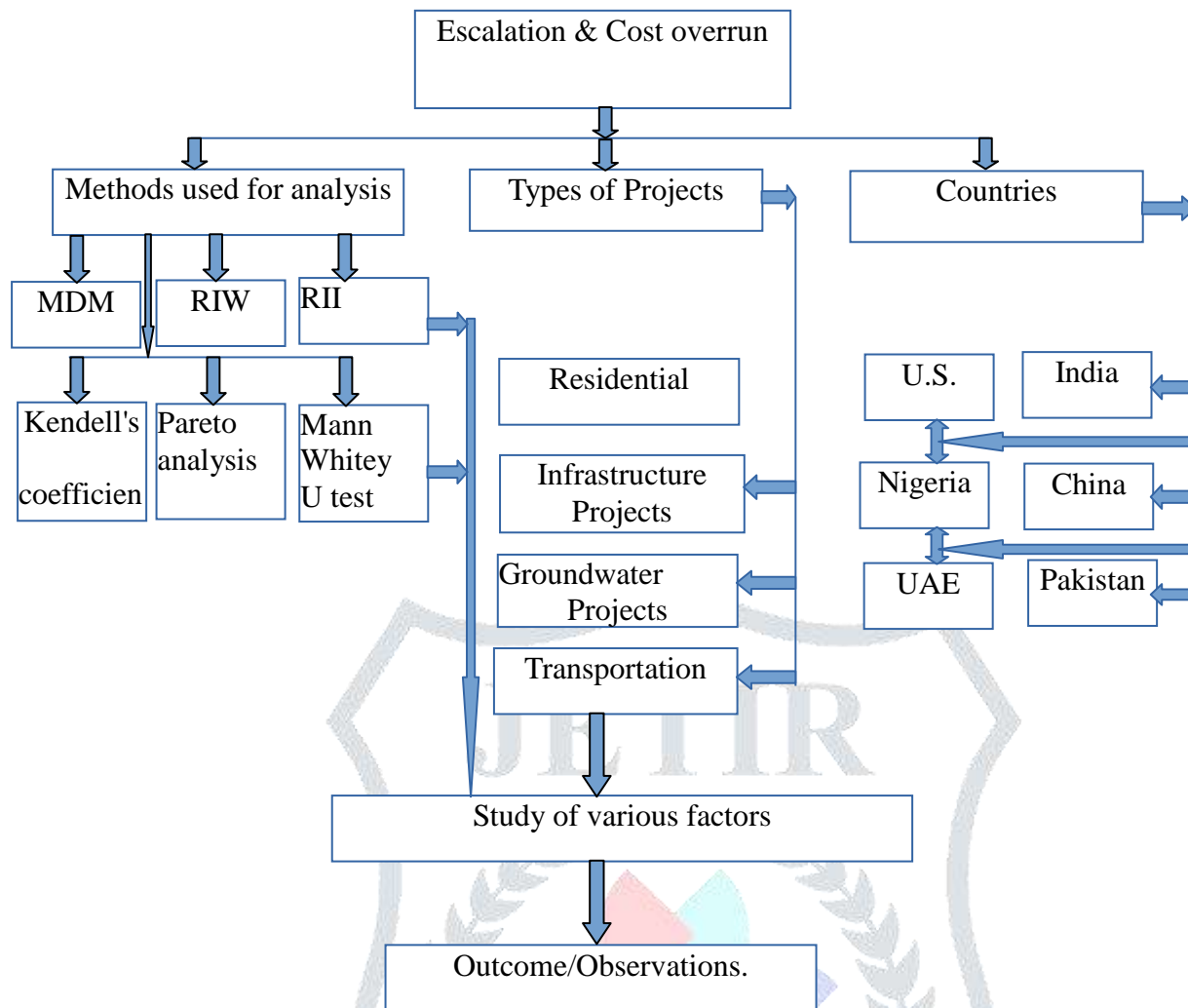
The analysis was done by using various techniques like RIW, Modified Delphi Method (MDM), Kawakita Jiro method (KJ), Kendall's coefficient, Relative Factor Weight etc.

## II. RESEARCH METHODOLOGY

To understand various factors affecting construction projects, literature review was carried out which includes analysis done by researchers in various countries like Nigeria, U.S., UAE, Pakistan, India.China etc.it was observed that, the study was done by interviews, personal interactions and questionnaire distribution.

The theme of this study to summarise the various methods used in the analysis of of the data collected from survey and understand the main factors affecting cost overrun of the construction projects.

Methodology adopted for this study is as under,



**III. SUMMARIZED INFORMATION OF THE WORK CARRIED OUT:-**

According to Table No 01, forty eight attributes considered to study the effect of various parameters on the construction. According to the author, data was collected from Clients Consultants, Contractors depending on their Experience and typical project Budget. The RIW Relative Importance Weight score is a used to measure the relative positioning of a particular attribute perceived by the respondents on the raw dataset. Multivariate regression analysis performed on eight factors’ scores highlighted the influence of five significant factors ( $p < 5\%$ ) on managing cost overruns. It was observed that the client’s responsibility in facilitating effective management of those factors within the project environment is crucial. Relative Importance Weight (RIW) was calculated as 2.458 for C28-Escalation of material prices.(Pg 272, Table no 3).Control of material price escalation depends on effective management of a procurement schedule and provision for relevant contractual arrangements among the suppliers.(Hemanta Doloi March 2013).

Reference No	No of attributes referred for study
1	48
2	52
3	20
4	31
6	11
7	44
8	7
9	55
11	18
12	42

Table No 1:- No of attributes considered for study (Source- Reference papers)

**Table No 1** shows No of attributes referred for the authors for their study.

For West Bank in Palestine, study was done to find the causes for delay in road construction projects. For this study, 11 variables of delay and 7 variables related to cost overruns was considered. Cost of material was increased by inflation, inaccurate quantity take-

off, and labour cost increased because of environment restriction is the first three causes of cost overruns. Approximately 75% of the participating contractors and 70% of the consultants indicated that the average time overrun for the projects they have experienced is between 10 and 30% of the original project duration.(Ibrahim Mahamid; Amund Bruland ; and Nabil Dmaidi ).

### **Study carried out in Nigeria:-**

In Nigeria study was done by considering architects, civil engineers, builders and quantity surveyors. Total 20 responses was collected through interviews and total 450 questionnaires were delivered by hand. It was found that there are good agreements between the various professionals in the industry. Better agreement was found between architects and engineers. For, Cross-Comparison of Relative Importance of Items Responsible for Delays and Cost Overruns Engineers and quantity surveyors disagreed for 78% of issues and between Clients and contractors it is 59.5%, Also for Cross Comparison of Relative Importance of Items Responsible for Cost Overruns Engineers and architects are agree for nearly 92% and Clients and contractors agree for only 58% given in table 6 & 7.(By Daniel C. Okpala, Anny N. Aniekwu).

For those factors which are leading to high construction cost, agreement between three professionals was done (architects, engineers, and quantity surveyors) by using with a Kendall's coefficient. Total 100 responses were collected from the northern part of Nigeria Jos, Kano, and Bauchi. In table no 6 shows the rank agreement for above three professionals. Point no 2 is related to price fluctuations. The rank agreement factor is 0.22 and percentage agreement factor is 93% with standard deviation is 36.0.(A. Uchechukwu Elinwa, and Silas A. Buba)

In the same country, study on construction Delays and their causative factors was done by (Ajibade Ayodeji Aibinu and Henry Agboola Odeyinka). Data was collected from completed building projects to assess the extent of delays. The data was collected from 44 different factors identified. Pareto analysis revealed that 88% of the factors (representing 39 highest priority factors) were responsible for 90% of the overall delays. Table 2. Includes various factor categories, Factor Names, and Factor Labels. Factor No 38 (F38) is related to Price escalation is between the top 10 factors who contribute for the to overall delays.

Table 6. shows Relative Factor Weight (%) of delays factors and Ranks (R) within category was given. For Price escalation, relative factor weight is 2.48 having category 1.(Ajibade Ayodeji Aibinu and Henry Agboola Odeyinka).

Now a days all countries are focusing on development of infrastructure which leads to high investment and lots of projects worldwide. Questionnaire was distributed and response were collected which are summarized in table no 1 as contractors, consultants, & public clients. The responses obtained are 41%, 35% & 24 %.The Severity index, was calculated and was observed that for Price fluctuations as 100% reported by all contractor, consultant and public client. The work is carried out for 23 different factors. In those factors, Price fluctuations is having rank 1.The ranking was carried out using the relative net difference between the mean severity index percentage and the standard error of mean percentage in order to achieve unambiguously the ranking for each variable factor. Empirical analysis revealed the consequences of project delays and cost escalation for some completed projects in Nigeria with these subsequent

Minimum average percentage escalation cost of projects in Nigeria was 14%; the minimum average percentage escalation period of projects in Nigeria was found to be 188% with an average percentage completion work of just 96%. (A. Omoregie, D.)

As construction industry is known as a unorganized industry. This lead to arise disputes in the industry between labours, engineers, contractors, client etc. Study was carried out (Sai On Cheung ; Tak Wing Yiu Yiu; and Sau Fung Yeung) so that negotiation shall get conducted o understand various factors plays important role in disputes. In this study, seven factors plays important role in negotiation out of which factor no 2 is related with escalation. The details of the factor are given in table no 4 Rotated Factor Matrix for Negotiation Outcomes. In this study the respondents' distribution is, Clients (61.40%) and contractors (38.60%) for 70 respondents. Factor 2 is described as conflict escalation because these outcomes are characterized by a higher level of conflict. As such, Factor 2 is identified as a dysfunctional outcome (Rahim 1992), i.e., an outcome having a negative connotation as the dispute is unlikely to be resolved with an escalating conflict.In table 6. Overall Results of Multiple Regression Analysis (for Dysfunctional Negotiation Outcomes) on pg.810 shows the  $R^2$  values represent the combined effect of the entire variate in prediction and range from 0.144 to 0.504. For Conflict escalation the value for  $R^2$  is 0.234.

### **Study carried out in United States:-**

In the same regard, detailed study was one by, (Jennifer S. Shane, Keith R. Molenaar, M., Stuart Anderson, and Cliff Schexnayder), for large transportation projects in U.S. construction industry. United States have overrun their initial budgets. This categorization of 18 primary factors which impact the cost of all types of construction projects was verified by interviews with over 20 state highway agencies. The data of Flyvbjerg et al. (2002) indicate that worldwide transportation construction costs are on average 28% higher than their estimated cost. Rail projects have the worst project under estimation track record with an average cost escalation of 44.7% (Table 1) pg.223, Bridge projects follow at 33.8% being underestimated and then road projects with an average cost escalation of 20.4%.Transportation projects on a whole are found to experience average cost escalation of 27.6%.News reports of high profile project cost escalation cause the public to lose confidence in the ability of agencies to effectively perform their responsibilities. Author has summarized cost escalation factors by cause and development Phase in Table 2. as Internal (Bias, Delivery/procurement approach, Project schedule changes, Engineering and construction complexities, Scope changes, Scope creep, Poor estimating, Inconsistent application of contingencies, Faulty execution, Ambiguous contract provisions, Contract document conflicts and external factors.) and external (Local concerns and requirements, Effects of inflation, Scope changes, Scope creep, Market conditions, Unforeseen events,



Unforeseen conditions). Knowledge of the cost escalation factors that impact project cost and an awareness of their potential significance is the first step to mitigation of prospective consequences. Actions may be taken internally to address the internal cost escalation factors, while communication, education, and engagement of external sources will aid in managing and anticipating external cost escalation factors. “the key to success is to realize and understand the challenges early in the planning process, to develop strategies to address them and to establish accurate and achievable expectations”(Capka 2004).

#### **Study carried out in UAE:-**

In UAE study was carried out to understand the causes of delay on construction projects by (Omayma Motaleb and Mohammed Kishk). In this regard, questionnaire survey that investigated 42 potential delay factors was carried out. Questionnaires were sent to 50 companies with a response rate of 70%. Monthly payment difficulties from agencies, poor contractor management; material procurement, poor technical performances, and escalation of material prices have been identified as the main delay factors in Ghana by Frimpong (2003). Five financial related causes of delay have been identified and are summarized in Table 5. are Inadequate fund allocation, High interest rate, Monthly payment difficulties, Inflation/prices fluctuation, delay payment to supplier/ subcontractor. The Relative Importance Index (RII) is calculated for all above factors. For Inflation/prices fluctuation the RII is 4.075 which is highest among the all five factors. Three of these factors are among the top 15 list (Table 7), Inflation/prices fluctuation is ranked no 7 in the list. These are: inflation and prices fluctuation, high interest rate and client’s financial difficulties. These results are logical given the recent high escalation of prices of steel and cement, the current credit crunch and the related economic crisis in Dubai. Forty two potential causes of construction projects delay have been identified and categorized into contractor, consultant, project managers, client, financial, and unforeseen categories. The significance of these factors has been investigated using the relative importance index method. The fifteen top causes of delay include 6 client-related factors, 4 project manager-related factors, 3 financial factors, and 2 contractor-related factors. Client-related factors seem to be the most significant causes of delay. This is followed by project team/ management related factors and various financial factors faced by the contractor.

#### **Study carried out in U.S. and India:-**

Organizational structure also plays important role in the delay of construction projects. David Arditi , Shruti Nayak , Atilla Damci has done study using questionnaire survey administered to construction companies located in the U.S. and India for collection of data. study show that construction organizations in the U.S. are dominated by “clan” culture whereas those in India are dominated by “market” culture. Despite the fact that delays are caused by a multitude of reasons often mentioned in the literature, statistical analysis indicates that there is also a significant relationship between organizational culture and the magnitude of delays. This relationship could be useful for a construction company in cultivating an organizational culture that is expected to reduce project delay. There is extensive literature on causes of delay in construction. Table 1 (pg 137) presents the major causes of delay in projects undertaken in twenty-three different countries, and sheds light on the most and least common causes of delay in construction. The most common causes of delay in construction are delays in owner payments to the contractor, design changes during construction, incomplete or improper design, and shortage of materials/equipment/manpower. Table 1 shows Major causes of delay in the construction industry, and Economic problems (e.g., inflation, fluctuation) having frequency 5 & highest frequency was observed for Delays in contractor's payment by owner as 20.

#### **Study carried out in Brazil:-**

Study was carried out in among the construction companies registered in the Construction Union in the municipalities of Balneário Camboriú and Itajai (Brazil), to study the delay for residential projects. The number of buildings delivered after the scheduled deadline in two cities between December 2009 and January 2011 was found (n = 542), and a sample of 82 residential units was taken. In order to obtain the data, a semi-structured questionnaire was given to the homeowners. It was observed that only 35% (n = 29) of the contracts included a penalty clause for delay. Delays can also cause loss of revenue when production facilities or rental units are not completed on time. As well, higher overhead costs may be incurred due to the longer work period and the inflation in the price of materials.( Estacio Siemann Santos Pereira, Cristine do Nascimento Mutti and Antonio Edesio Jungles)

#### **Study carried out in China:-**

Ying-Mei Cheng has done study on cost-influencing factors related construction projects. For this Modified Delphi Method (MDM) with 2 groups and 2 rounds and Kawakita Jiro method (KJ) to consolidate the experts' opinions and identify and rank the key factors that affect project costs was used. 90 cost-influencing factors are collected from literary review and interviews with experts with practical cost control experiences in the construction companies (Group 1). The KJ method is used to consolidate these factors into 4 categories and down to a total of 42 factors. 2 rounds of questionnaires are then conducted to filter the key factors. In order to verify views of those in the first group, Group 2 consists of experienced experts from the public sectors, consulting firms and construction companies as a comparison. Results of the analysis indicate that there are 16 key cost-influencing factors. Severity Index computation was then adopted to rank these key cost-influencing factors.

Hydro projects are considered as a huge projects having huge budget as well as time required to complete this type of project is also more this leads overrun of the project. According to Yaw Frimpong , Jacob Oluwoye , Lynn Crawford,2003, main causes of delay and cost overruns in construction of groundwater projects included: monthly payment difficulties from agencies; poor contractor

management; material procurement; poor technical performances; and escalation of material prices. The five most important factors agreed by the owners, contractors and consultants, as the main causes were given in Table 2, monthly payment difficulties from agencies, poor contractor management, material procurement, poor technical performances, and escalation of material prices. For this study Owners Contractors & Consultants was involved. Number of respondents are 28,25, & 19 out of 125. Relative Importance Weight (RIW) was calculated for 26 different factors. Escalation of material prices have RIW as 4.48 given by owners and 4.57 by Contractors & 4.37 by Consultants. Overall RIW is 6.

Cost escalation and schedule delays in road construction projects in Zambia was carried out by Chabota Kaliba, Mundia Muya, Kanyuka Mumba, 2008. The data was collected using structured interviews and questionnaires surveys, literature review and case studies of road construction projects in the country.

The questionnaire survey, which was designed to determine the major causes and effects of cost escalation and schedule delays in road projects, was targeted at 60 participants using the disproportionate stratified sampling technique. The response rate for the questionnaire survey was 43%, 70% of which was shared equally between contractors and consultants while clients had 30% representation.

The academic qualifications of the questionnaire survey respondents were assessed. As shown in Fig. 2, out of 26 participants 27% of the respondents had a diploma in engineering, 50% had a bachelor's degree in civil engineering while 23% had a masters of science in engineering.

Fig. 3 on page 527 shows that 31% of the respondents had worked in the construction industry for more than sixteen years, 23% for eleven to sixteen years, 27% for six to ten years while the rest had worked for five years or less.

Results of questionnaire surveys showed that there were eight major causes of cost escalations that predominantly affect road construction projects in Zambia. From Fig. 4, bad weather, mainly heavy rainfall and floods, scored the highest weighted average of 73%. It was followed by scope changes which scored 63% and environmental protection and mitigation cost which scored 61%. Schedule delay scored 54% while strikes had 52%. The others were local government pressures, technical challenges and inflation which all scored 50%.

#### **Study carried out in Pakistan:-**

To study cost escalation factors, 52 responses were collected from construction industry in Pakistan by Salman Ahmed Aftab Hameed Memon Noor Ahmed Memon, 2018. Distribution of questionnaire was constructor 54%, client 36% & consultant 10%. Pakistan construction industry is vulnerable to several threats. Two of the most important are cost escalation and time overrun. Through a review of previous research works, carried out globally, in cost escalation area of study, a total of 30 factors were considered. Inflation & fluctuation in material prices is having rank 3 & 4 respectively.

#### **IV. CONCLUSION AND POTENTIAL SUGGESTIONS:**

1. It was observed that most of the projects in Nigeria are facing delay in construction projects only due to fluctuation in prices which leads to increase in project cost as escalation plays most important role.
2. Understanding between client, contractor, architect and quantity surveyor plays a vital role in minimizing the escalation cost for the projects.
3. For infrastructure projects cost escalation plays a very important role and also cause of disputes.
4. In Zambia, for road construction projects, technical challenges and inflation scored 50% weightage.
5. The issues faced in developing country and developed country are different but all leads to cost overrun.
6. The main outcome of this study is to provide summarize information about the problems faced by construction industry related to cost overrun/escalation.
7. It was observed that certain fixed /common problems leads to raise cost overrun/escalation in the construction projects.
8. Various methods used for calculation of impact factors highlights escalations a major factor for cost overrun.

**V. RERERANCES:**

- 1.Hemanta Doloi," Cost Overruns and Failure in Project Management: Understanding the Roles of Key Stakeholders in Construction Projects",Journal of Construction Engineering and Management © ASCE / MARCH 2013 / 267-279.
- 2.Ibrahim Mahamid; Amund Bruland; and Nabil Dmaidi,"Causes of Delay in Road Construction Projects",Joual of management in Engineering © ASCE / JULY 2012,300-310.
- 3.By Daniel C. Okpala, and Anny N. Aniekwu, "Causes of high costs of construction in Nigeria", Journal of Construction Engineering and Management , 1988, 114(2): 233-244.
- 4.BUchechukwu Elinwa,Silas A."Buba, Construction cost factors in Nigeria", Journal of Construction Engineering and Management .,1993,119(4):698-713.
- 5.Ajibade Ayodeji Aibinu and Henry Agboola Odeyinka,Construction Delays and Their Causative Factors in Nigeria,Journal of Construction Engineering and Management © ASCE / July 2006 / 667-677.
- 6.Sai On Cheung; Tak Wing Yiu Yiu; and Sau Fung Yeung,A Study of Styles and Outcomes in Construction Dispute Negotiation,urnal of Construction Management © ASCE / August 2006 / 805-814.
- 7.Jennifer S. Shane, A.M.ASCE; Keith R. Molenaar, M.ASCE; Stuart Anderson, M.ASCE; and Cliff Schexnayder, Dist.M.ASCE,Construction Project Cost Escalation Factors, Journal of Construction Engineering and Management © ASCE / OCTOBER 2009 / 221-229.
- 8.David Ardit , Shruti Nayak , Atilla Damci,Effect of organizational culture on delay in construction, International Journal of Project Management 35 (2017) 136–147
- 9.Estacio Siemann Santos Pereira, Cristine do Nascimento Mutti and Antonio Edesio Jungles, Prevision of Delay in Brazilian Residential Unit Construction Contracts,Journal of Civil Engineering and Architecture, ISSN 1934-7359, USA,Jan. 2014, Volume 8, No. 1 (Serial No. 74), pp. 100-106.
- 10.Ying-Mei Cheng,An exploration into cost-influencing factors on construction projects,International Journal of Project Management xx (2013) xxx–xxx,Received 22 May 2013; received in revised form 30 August 2013; accepted 3 October 2013.
- 11.Yaw Frimpong,Jacob Oluwoye,Lynn Heather Crawford,Causes of delay and cost overruns in construction of groundwater projects in a developing countries; Ghana as a case study,International Journal of Project Management · July 2003,International Journal of Proje Management 21 (2003) 321–32.
- 12.Chabota Kaliba , Mundia Muya, Kanyuka Mumba,Cost escalation and schedule delays in road construction projects in Zambia,International Journal of Project Management 27 (2009) 522–531.
- 13.Omoregie, Alohan; Radford, Dennis,Infrastructure delays and cost escalation: Causes and effects in Nigeria,Proceedings of the 6th International Postgraduate Research Conference in the Built and Human Environment, International Council for Research and Innovation in Building and Construction.pg. 79-93.
14. Global construction market to grow \$8 trillion by 2030: driven by China, US and India, by Global Construction Perspectives and Oxford Economics Broadwall House, 21 Broadwall London SE1 9PL United Kingdom.
- 15.International construction market survey 2017,Building Momentum.
- 16.Salman Ahmed,Aftab Hameed Memon,Noor Ahmed Memon,Abdul Nasir Laghari,Muhammad Akram Akhund,Hafiz Usama Imad,"Common Factors of Cost Escalation in Construction Industry of Pakistan",Engineering, Technology and Applied Science Research · December 2018,Vol. 8, No. 6, 2018, 3508-3511 3508.
17. Global Construction 29-30,Oxford Economics, Global Construction Perspectives and Oxford Economics Broadwall House, 21 Broadwall London SE1 9PL, United kigdom.
22. International construction market survey 2017, Building momentum.
23. Omayma Motaleb, and Mohammed Kishk, An Investigation into causes and effects of construction delays in UAE, The Scott