

## **Preliminary Study on Causative Factors Leading to Construction Cost Overrun**

Aftab Hameed Memon<sup>\*1</sup>, Ismail Abdul Rahman<sup>2</sup>, Ade Asmi Abdul Azis<sup>3</sup>

<sup>1,2,3</sup>Faculty of Civil and Environmental Engineering  
Universiti Tun Hussein Onn Malaysia, 86400 Parit Raja - Batu Pahat, Johor, Malaysia

\*Corresponding E-mail : aftabm78@hotmail.com

---

### **ABSTRACT**

Cost is the fundamental component for any construction project. However, cost overrun is observed as one of the most frequently occurring issues in construction projects worldwide and need to be studied more to alleviate this issue in the future. This trend is more severe in developing countries where these overruns sometimes exceeds 100% of the anticipated cost of the project.

Like other countries, construction industry in Malaysia is also facing a lot of challenges such as the delay to complete the project in time, the expenditure exceeding the budget, the building defects and over dependent of foreign workers. The ultimate effects of project delay also results in exceeding cost. This leads to serious need of addressing the critical issue of construction cost overrun. To avoid construction cost overrun, very first and most important step is to identify and understand the causes and factors responsible for that. Hence, this paper is aimed to identify various factors responsible for construction cost overrun. Through a comprehensive study of literature review, common factors causing cost overrun resulting in identification of 78 factors were mapped in frequency table. A questionnaire survey and interviews were carried out amongst selected experienced personnel for expert opinion to identify the significant factors causing cost overrun in Malaysia. Five respondents were selected from each of the respondents groups including client, consultant and contractor. The questionnaire responses were analyzed by average index method, which resulted in identification of 59 common factors causing construction cost overrun in Malaysia. Results show that poor design & delays in Design, unrealistic contract duration & requirements imposed, lack of experience, late delivery of materials & equipment, relationship between management & labour, delay preparation & approval of drawings, inadequate planning & scheduling, poor site management & supervision and mistakes during construction were most common and significant factors causing cost overrun in Malaysian construction industry as perceived by experts

**Keywords:** *Cost Overrun, Construction Industry, Malaysia, Mapping Study, Causes of Cost Overrun*

---

*\*Corresponding Author*

## **1.0 INTRODUCTION**

The basic goal of practitioner involved in any industry is to achieve the completion of project within time and stipulated budget. But due to nature of construction industry i.e. one of the most complex, fragmented, schedule and resource driven industry, it is always facing serious problems like low productivity, low quality, delay, cost overrun etc.

Achieving project completion on time and within budget at specified quality standards is major criterion of success of project [1, 2, 3]. Therefore, to manage and control projects, there are various procurements strategies being adopted. Most popular strategies include traditional, management, integrated services and in-house teams [4]. However, despite of adopting various management practices, construction projects in many countries are still faced with the problem of project delay and cost overrun. [5, 6, 7, 8]. Vietnamese government acknowledged the construction delays and cost overruns problems as the big headache, especially with government-related funded projects [cited by 9]. A study of more than 4000 construction projects showed that projects were rarely finished on time, or within the allocated budget [10].

Like other countries, in Malaysia also the construction industry is one of major industry contributing significant growth to socio-economic development. In recent years, there has been rapid growth of the industry in Malaysia. Although a lot of money has been spent in construction, the industry is facing a lot of challenges such as delay to complete the project on time, expenditure exceeding the budget, construction defects and dependency on foreign workers [11]. To control construction projects in Malaysia, various procurement strategies are commonly adopted. These include traditional lump sum system, design and build/turnkey system and Construction Project Management/Contract Management [12, 13]. Majority of the construction projects are facing chronic problem of construction. One of the common problems is project delay resulting in time and cost overruns, disputes, arbitration, and even total abandonment [14]. In MARA case, more than 90% of the projects experience delay resulting significant amount of time and cost overrun [15].

Angelo and Reina [16] stated that the problem of cost overruns is critical and should be further explored to mitigate this problem in future. They also point out that cost overruns are a major problem in both developing and developed countries. The trend is more acute in developing countries where these overruns sometimes exceeds 100% of the estimated project cost. Lack of management system and lack of ability to prevent cost overruns or to control construction costs causes construction companies to fail [17]. This leads to need of effective cost management system and cost control system. To avoid this problem, the important steps are to identify and understand the causes and factors responsible for this. Hence, the purpose of this study is to identify the main sources affecting construction cost.

## **2.0 RELATED WORKS**

Time and cost are among the major considerations throughout the project management life cycle and can be regarded as the important parameters of a project and the driving force of project success. Despite its proven importance it is not uncommon to see a construction project failing to achieve its objectives within the specified within stipulated time and cost. Time and cost overruns occur in most construction projects vary

considerably in its magnitude from project to project. Time overrun and cost overruns factors have contributed to the high cost of construction in many countries for many years [18,19,20,21]. The factors are common problems in construction faced by many countries [14, 15, 22, 23, 24, 25]. Research works had shown that Time overrun has positive and strong linear relationship with cost overrun [15, 26]. It will lead to a negative rate of national economic growth and monetary loss [8, 27, 28, 29]. Therefore, it is important to unearth the actual causes affecting construction cost. This will help to control and achieve construction project within estimated cost.

Several scholars have conducted studies to on the issue of construction cost overrun in order to identify the causative factors. Some researchers argue that construction cost overrun is one of the effects of project delay. The responsibility for project delay is reflected in whether the contractor is liable for costs and additional time to complete the project [30]. In the study of the growing problem of construction delay in Nigeria, through a questionnaire survey and study of 61 construction projects, [25] concluded that cost overrun is one of the effects of project delay.

In Ghana [23] studied 26 factors that cause cost overruns in construction of ground water projects and found that according to the contractors and consultants, monthly payments difficulties was the most important cost overruns factor, while owners ranked poor contractor management as the most important factor. Despite some difference in viewpoints among the three groups surveyed, there is a high degree of agreement among them with respect to their ranking of the factors. The overall ranking results indicate that the three groups felt that the major factors that can cause excessive groundwater project cost overruns in developing countries are poor contractor management, monthly payment difficulties, material procurement, poor technical performances, and escalation of material prices. In Kuwait [31] studied delays and cost increases in the construction of private residential projects and found that cost-increases was greater when the total cost of a residential project was higher. A major factor contributing to the time-delay and cost-increase was the inadequacy of money and time allocated to the design phase. The three main causes of cost overruns on the other hand were, in order, contractor-Elide and material-related problems and, again, owners' financial constraints. Four major factors that cause cost overruns are design changes, inadequate planning, unpredictable weather conditions; and fluctuations in the cost of building materials [32, 33].

Time overrun is one of major factor causing cost overrun. Research works had shown that Time overrun has positive and strong linear relationship with cost overrun [15, 26]. In Saudi Arabia [34] found that about 70% of the projects experienced time overruns. In Malaysia, [35] found 15 causative factors responsible for cost overrun in MARA large projects. The results showed that Cash flow and financial difficulties faced by contractors, Contractor's poor site management and supervision, Inadequate contractor experience, Shortage of site workers and Incorrect planning and scheduling by contractors were more significant factors affecting construction cost. Also, from correlation analysis it was perceived that "Incorrect planning and scheduling by contractors with Contractor's poor site management and supervision", "Contractor's poor site management and supervision with inadequate contractor experience", "Incorrect planning and scheduling by contractors with inadequate contractor experience" and "Frequent design changes with Change in the scope of the project" have strong positive correlation with each other.





significant, 3=MS= moderately significant, 4=SS= slightly significant, 5=NS= not significant. Data was analyzed by using average index method as follows:

$$AI = \frac{\sum(1X1+2X2+3X3+4X4+5X5)}{\sum X1+X2+X3+X4+X5} \dots\dots\dots(1)$$

Where;

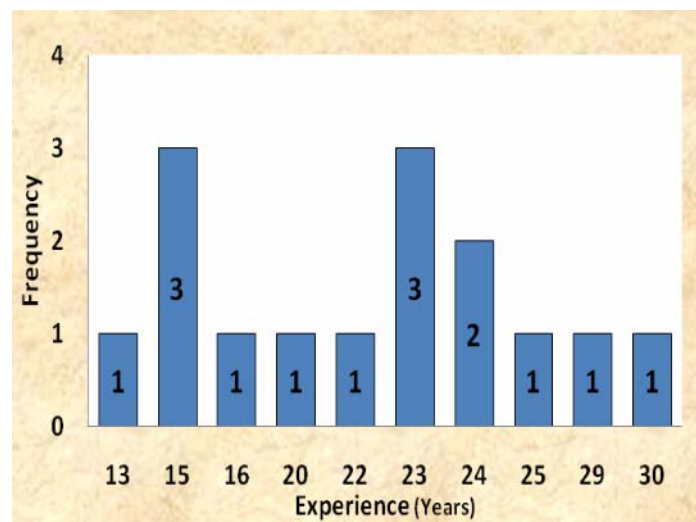
- X1 = No of respondents for “Extremely Significant”
- X2 = No of respondents for “Very Significant”
- X3 = No of respondents for “Moderately Significant”
- X4 = No of respondents for “Slightly Significant”
- X5 = No of respondents for “Not Significant”

Evaluation ranges to assess significant level as adopted by [70,71] was used in this study as follows:

1.00 < AI < 1.50	Extremely Significant
1.50 < AI < 2.50	Very Significant
2.50 < AI < 3.50	Moderately Significant
3.50 < AI < 4.50	Slightly Significant
4.50 < AI < 5.00	Not Significant

## 5.0 RESULTS AND DISCUSSION

The respondents in questionnaire survey had involved in construction industry for many years. **Figure 1** shows the frequency of respondents based on working experience. The figure shows that majority of respondents had more that 20 years working experience in construction industry.



**Figure 1:** Frequency of experience of respondents

Data collected in the questionnaire was analyzed using average index method and results are shown in table 2. From results, the factors with Average Index from 1.00 to 2.50 were selected as common factors affecting construction cost. This resulted in identifying 59 factors of affecting construction cost as presented in table 3.

Table 2: Results of Questionnaire Survey (Expert Opinion)

CAUSES OF COST OVERRUN	Expert Opinion																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15						
Type of organization	CLI	CLI	CLI	CLI	CLI	COS	GLC	COS	COS	COS	CON	CON	CON	CON	CON						
Experience (In Years)	15	29	24	23	25	30	20	23	23	24	22	15	16	13	15						
1 Poor design and delays in Design	2	2	1	3	4	1	1	3	1	1	2	1	1	1	2	8	4	2	1	0	1.73
2 Unrealistic contract duration and requirements imposed	2	1	1	3	3	1	1	2	1	1	2	3	1	1	3	8	3	4	0	0	1.73
3 Lack of experience	2	1	1	2	3	1	1	2	1	2	1	3	2	1	3	7	5	3	0	0	1.73
4 Late delivery of materials and equipment	3	3	2	1	1	1	2	4	1	1	2	1	2	1	2	7	5	2	1	0	1.80
5 Relationship between management and labour	3	2	3	2	3	5	3	4	3	2	2	2	3	2	3	6	7	1	1	0	1.80
6 Delay Preparation and approval of drawings	2	2	1	3	4	1	2	3	1	1	2	1	1	1	2	7	5	2	1	0	1.80
7 Inadequate planning and scheduling	2	2	1	3	3	1	2	2	1	1	1	2	2	1	3	6	6	3	0	0	1.80
8 Poor site management and supervision	2	2	1	2	3	1	2	3	1	1	1	3	1	1	3	7	4	4	0	0	1.80
9 Mistakes during construction	2	1	3	3	4	1	2	2	2	1	1	1	1	1	2	7	5	2	1	0	1.80
10 Changes in Material Specification and type	2	3	1	1	1	2	2	3	2	2	2	2	1	2	1	3	5	7	3	0	1.87
11 Cash flow and financial difficulties faced by contractors	2	1	2	1	3	1	1	4	1	2	2	3	1	1	3	7	4	3	1	0	1.87
12 Poor financial control on site	2	3	2	2	1	2	1	2	1	2	1	2	1	1	3	5	7	3	0	0	1.87
13 Frequent design changes	2	2	1	3	4	2	1	3	1	2	2	1	1	1	2	6	6	2	1	0	1.87
14 Delay in Material procurement	3	3	1	3	3	1	1	2	2	1	1	2	2	1	2	6	5	4	0	0	1.87
15 Inaccurate Time and Cost estimates	2	2	1	2	4	2	1	3	1	1	1	3	2	1	2	6	6	2	1	0	1.87
16 Delays in decisions making	2	2	3	2	2	1	1	3	1	2	1	2	2	1	2	5	7	3	0	0	1.87
17 Rework	2	2	3	2	4	1	2	2	1	1	1	2	1	1	3	6	6	2	1	0	1.87
18 Financial difficulties of owner	2	4	1	1	3	1	1	4	2	2	2	1	1	1	2	6	6	1	2	0	1.93
19 Inaccurate Site investigation	2	2	1	2	3	4	1	2	1	1	1	4	1	1	3	7	4	2	2	0	1.93
20 Inadequate monitoring and control	2	2	1	2	4	2	2	3	2	1	1	2	1	1	3	5	7	2	1	0	1.93
21 Poor project management	2	2	3	2	3	1	2	3	2	1	1	2	1	1	3	5	6	4	0	0	1.93
22 Shortage of site workers	2	3	3	1	3	1	2	3	2	1	2	3	1	1	2	5	5	5	0	0	2.00
23 Poor Contract management	2	3	1	2	4	2	1	3	1	1	2	3	2	1	2	5	6	3	1	0	2.00
24 Additional works	2	2	1	3	3	1	1	3	2	2	2	3	1	1	3	5	5	0	0	0	2.00
25 Incomplete design at the time of tender	2	2	1	2	4	3	1	2	1	3	2	1	1	1	2	3	5	6	3	1	2.00
26 Mistakes and Errors in design	2	1	2	2	4	3	1	2	1	2	2	3	1	1	3	5	6	3	1	0	2.00
27 Incompetent subcontractors	3	2	1	2	4	1	2	4	2	1	1	2	2	1	2	5	7	1	2	0	2.00
28 labour productivity	2	3	4	1	4	1	2	3	1	1	2	1	2	1	3	6	4	3	2	0	2.07
29 Slow information flow between parties	2	2	3	2	3	1	2	4	2	1	1	2	2	1	3	4	7	3	1	0	2.07
30 Lack of communication between parties	2	2	2	2	4	2	2	4	2	1	1	2	1	1	3	4	8	1	2	0	2.07
31 Mode of financing, bonds and payments	3	2	1	2	4	1	2	3	3	2	3	1	1	1	3	5	4	5	1	0	2.13
32 Schedule Delay	2	2	5	1	3	1	2	3	1	1	2	2	2	1	3	5	5	4	0	1	2.13
33 Fluctuation of prices of materials	2	2	3	1	5	2	2	4	1	3	1	1	1	1	3	5	5	3	1	1	2.20
34 Shortages of materials	3	3	2	1	1	1	2	4	3	1	2	2	1	4	3	5	4	4	2	0	2.20
35 Equipment availability and failure	3	3	2	1	2	1	2	4	2	2	2	1	2	4	2	3	8	2	2	0	2.20
36 shortage of technical personnel (skilled labour)	2	3	3	1	2	2	2	3	2	1	2	2	2	3	3	2	8	5	0	0	2.20
37 Waste on site	2	2	1	3	3	4	2	4	1	2	1	2	1	2	3	4	6	3	2	0	2.20
38 Lack of experience of technical consultants	2	3	3	3	4	2	2	3	1	2	1	1	2	1	3	4	5	5	1	0	2.20
39 Lack of coordination between parties	2	2	3	2	3	2	2	4	2	1	1	3	2	1	3	3	7	4	1	0	2.20





**Table 3: Factors Affecting Construction Cost**

S.No	Factors Affecting Cost Overrun	Average Index (AI)
1	Poor design and delays in Design	1.73
2	Unrealistic contract duration and requirements imposed	1.73
3	Lack of experience	1.73
4	Late delivery of materials and equipment	1.80
5	Relationship between management and labour	1.80
6	Delay Preparation and approval of drawings	1.80
7	Inadequate planning and scheduling	1.80
8	Poor site management and supervision	1.80
9	Mistakes during construction	1.80
10	Changes in Material Specification and type	1.87
11	Cash flow and financial difficulties faced by contractors	1.87
12	Poor financial control on site	1.87
13	Frequent design changes	1.87
14	Delay in Material procurement	1.87
15	Inaccurate Time and Cost estimates	1.87
16	Delays in decisions making	1.87
17	Rework	1.87
18	Financial difficulties of owner	1.93
19	Inaccurate Site investigation	1.93
20	Inadequate monitoring and control	1.93
21	Poor project management	1.93
22	Shortage of site workers	2.00
23	Poor Contract management	2.00
24	Incomplete design at the time of tender	2.00
25	Mistakes and Errors in design	2.00
26	Additional works	2.00
27	Incompetent subcontractors	2.00
28	labour productivity	2.07
29	Slow information flow between parties	2.07
30	Lack of communication between parties	2.07
31	Mode of financing, bonds and payments	2.13
32	Schedule Delay	2.13
33	Fluctuation of prices of materials	2.20
34	Shortages of materials	2.20
35	Equipment availability and failure	2.20
36	shortage of technical personnel (skilled labour)	2.20
37	Waste on site	2.20
38	Lack of experience of technical consultants	2.20
39	Lack of coordination between parties	2.20
40	High cost of labour	2.27
41	Bureaucracy in tendering method	2.27
42	Number of construction going on at same time	2.27
43	Effect of weather	2.27
44	Inaccurate quantity take-off	2.33
45	Delay in inspection and approval of completed works	2.33

46	lack of constructability	2.33
47	Delay in progress payment by owner	2.40
48	Contractual claims, such as, extension of time with cost claims	2.40
49	Impractical and complicated design	2.40
50	Change in the scope of the project	2.40
51	Omissions and errors in the bills of quantities	2.40
52	Obsolete or unsuitable construction methods	2.40
53	Insufficient Numbers of equipment	2.47
54	High cost of machinery and its maintenance	2.47
55	Labour Absenteeism	2.47
56	Severe overtime	2.47
57	Delay payment to supplier /subcontractor	2.47
58	Owner interference	2.47
59	Unforeseen ground condition	2.47

From table 2 and table 3, it can be perceived that Poor design and delays in Design, Unrealistic contract duration and requirements imposed and Lack of experience with AI of 1.73 are most significant and common factors affecting construction cost at first rank. On the contrary, mapping literature review as given in table 1, poor design & delays in design is 46<sup>th</sup> ranked factor, unrealistic contract duration & requirements imposed is 10<sup>th</sup> frequent factor and lack of experience as 15<sup>th</sup> frequent occurring factor affecting construction cost. Similarly, table 2 shows that experts ranked late delivery of materials & equipment, relationship between management & labour, delay preparation & approval of drawings, inadequate planning & scheduling, poor site management & supervision and Mistakes during construction with AI equal to 1.80 were ranked as second ranked most significant factor. While table 1 shows that based on literature review late delivery of materials & equipment is ranked as 6<sup>th</sup> frequently occurring factor affecting construction cost, relationship between management & labour as 59<sup>th</sup> ranked, delay preparation & approval of drawings as 47<sup>th</sup> ranked, inadequate planning & scheduling as 2<sup>nd</sup> ranked factor, poor site management & supervision as 13<sup>th</sup> ranked and mistakes during construction is 30<sup>th</sup> ranked frequently occurring caused of cost overrun.

## 6.0 Comparison from the Survey Results and Previous Studies

The causative factors of cost overrun obtained through the survey among the selected experts involved of Malaysian construction industry are compared with the factors mapped from previous studies conducted as in **Table 4**. The table compares top ten important factors from the survey and from the previous studies.

**Table 4:** Comparison of expert opinion and literature review of causes of cost overrun

Survey Results	Ranks	Previous Study Results	Ranks
Poor design and delays in Design	1	Effect of weather	1
Unrealistic contract duration and requirements imposed	2	Inadequate planning and scheduling	2
Lack of experience	3	Shortages of materials	3
Late delivery of materials and equipment	4	Shortage of site workers	4
Relationship between management	5	Delays in decisions making	4

and labour			
Delay Preparation and approval of drawings	<b>6</b>	Late delivery of materials and equipment	<b>5</b>
Inadequate planning and scheduling	<b>7</b>	Fluctuation of prices of materials	<b>6</b>
Poor site management and supervision	<b>8</b>	Frequent design changes	<b>7</b>
Mistakes during construction	<b>9</b>	Laws and Regulatory Framework	<b>7</b>
Changes in Material Specification and type	<b>10</b>	Unrealistic contract duration and requirements imposed	<b>7</b>

The comparison shows the selections from experts are moderately similar to the previous studies. Results show that poor design and delays in design is ranked as the most significant cause of cost overrun as perceived by experts of Malaysian construction industry whereas the previous study mapping found that this factor ranks at 46th frequently occurring cause.

On the other hand, unrealistic contract duration and requirements imposed is ranked as 2nd most significant factor in Malaysia. Similarly, this factor is within the top ten of the previous studies with the 7th frequent factor rank. Contract duration is very important factor for success of any project, as it ensures the completion of any work within estimated time and cost. If contract duration is not estimated correctly, project might delay resulting in cost overrun. [40] also found that inadequate contract duration was moderately significant factor causing construction cost overrun in Pakistan.

Likewise, survey results perceived from expert opinion shows that Lack of experience is the 3rd most important factor causing cost overrun in construction projects. Literature shows that this factor is 8<sup>th</sup> frequently occurring causative factor affecting construction cost. The absence of adequate experience may lead to various problems in construction projects. If contractor has lack of experience in handling project, this might cause delay or waste of material. Ultimately this will affect on cost of project. A study in Nigeria found that lack of experience was the most significant factor (with 1st rank) causing cost overrun of projects [37].

Late delivery of materials and equipment was found 4<sup>th</sup> major factor causing cost overrun. This result is almost similar with other studies that ranked this factor in 5<sup>th</sup> place of frequently occurring factors. Experts of Malaysian construction industry argue that late delivery of resources affects on working productivity significantly which causes delay in project and resulting in cost overrun. Other most significant factors were relationship between management and labour ranked as 5th, Delay Preparation and approval of drawings ranked as 6th, Inadequate planning and scheduling ranked as 7th. While literature review shows that inadequate planning and scheduling is 2nd most frequently occurring factor. Poor site management, mistakes during construction and changes in material specification and type were also reported as important factor causing construction cost overrun.

## **7.0 CONCLUSION**

Achieving project completion within the budgeted cost is the very fundamental and essential criteria of any successful project. To ensure this, various procurement system and methodologies are being practiced. However, construction industry is still facing many issues including project delay and cost overrun worldwide. The causative factors of construction cost overrun were investigated with experience personnel involved in construction industry of Malaysia to validate the contents of addressing issue of construction cost overrun in Malaysia. Through literature review 78 factors were identified. Through a structured questionnaire and interviews expert respondents 59 common and significant factors were identified. It involved 5 experience respondents from each of three key groups involved in construction i.e. client, consultant and contractor. Results showed that poor design & delays in design, unrealistic contract duration and requirements imposed and lack of experience, late delivery of materials and equipment, relationship between management and labour, delay Preparation and approval of drawings, inadequate planning and scheduling, poor site management and supervision and mistakes during construction are most significant and common factors affecting construction cost. Results also showed that the causative factors affecting cost overrun selected by experts are moderately similar to the previous studies.

## **8.0 FUTURE STUDY**

This study is part of PhD research. The scope of study will be extended to identify the significant causes of construction cost overrun in Malaysia using the results presented in table 3. Finally a cost control system will be developing by reducing causative factors

## **9.0 ACKNOWLEDGEMENT**

The authors would like to thank University Tun Hussein Onn Malaysia for supporting this study. Also we are thankful to construction practitioners for providing comprehensive and important information and a lot of cooperation which made data collection easier.

## **10.0 REFERENCES**

- [1] NEDO 1988. *Faster building for commerce* HMSO, UK
- [2] Chan, D.W.M and Kumaraswamy, M. M (1993). A Survey of time-cost relationship in Hong Kong construction projects. *Building Technology and Management Journal*, Vol. 20, Pages: 54-72
- [3] Rwelamila, P.D and Hall, K. A (1995). Tool systems intervention: an integrated approach to time, cost and quality management. *Construction Management and Economics*, Vol 13, pages: 235-241
- [4] Ofori, G (1990). *The Construction Industry; aspects of its economics and management*, Singapore University Press
- [5] Tah, J; Thorpe, A and McCaffer, R (1993). Contractor project risks contingency allocation using linguistic approximation. *Computing Systems in Engineering*, Vol 2 (4), pages: 281-93.
- [6] Assaf, S.A., Kalil, M and Al-Hazmi, M. (1995). Causes of delay in large building construction projects. *Journal of Management in Engineering*, Vol 11 (2), pages: 45-50.
- [7] Rad, P. (1979). Delays in construction of nuclear power plants. *Journal of Energy Division, ASCE*, Vol 105 (1), pages: 33-46.
- [8] Arditi, D., Akan, G. and Gurdamar, S. (1985). Reasons for delays in public projects in Turkey. *Journal of Construction Management and Economics*, Vol 3 (2), pages: 171-81.
- [9] Le-Hoai, L; Lee, Y. D and Lee J. Y (2008). Delay and Cost Overruns in Vietnam Large Construction Projects: A Comparison with Other Selected Countries, *KSCE Journal of Civil Engineering*, Vol 12 (6), Pages: 367-377
- [10] Morris, P and Hough, G (1989). *The Anatomy of Major Projects*, John Wiley & Sons Ltd, New York.

- [11] CIDB news (2007), issue 3
- [12] CIDB (2007), *Construction Industry Master Plan 2006-2015*,
- [13] Abdul Rashid, K (2002). *Construction Procurement in Malaysia*, International Islamic University Malaysia
- [14] Sambasivan, M and Soon Y. W (2007). Causes and effects of delays in Malaysian construction industry, *International Journal of Project Management*, Vol 25, pages: 517–526
- [15] Abdullah MR, Abdul Azis AA and Abdul Rahman I (2009). Causes of delay and its effects in large MARA construction project. *International journal of Integrated Engineering (Issue on Mechanical, Materials and Manufacturing Engineering)*
- [16] Angelo, W. J and Reina, P. (2002). Mega projects Need More Study Up Front to Avoid Cost Overruns
- [17] Sriprasert E (2000). *Assessment of Cost Control System: A Case Study of Thai Construction Organizations*. M.S. thesis, Bangkok: Asian Institute of Technology
- [18] Okpala, D.C. and Aniekwu, A.N. (1988). Causes of high costs of construction in Nigeria, *Journal of Construction Engineering and Management*, ASCE, Vol. 114 (2), Pages: 233-234.
- [19] Charles, T.J. and Andrew, M.A. (1990). Predictors of cost overrun rates, *Journal of Construction Engineering and Management*, ASCE, Vol. 116 (3), pages: 548-52.
- [20] Zaki, M.K. and James, E.D. (1987). Concurrent delays in construction projects, *Journal of Construction Engineering and Management*, ASCE, Vol. 113 (4), pages: 591-602.
- [21] Abdul-Rahman, H., Yahya, I., Berawi, A. and Wah, L.W. (2008). Conceptual delay mitigation model using a project learning approach in practice”, *Construction Management and Economics*, Vol. 26, pages: 15-27.
- [22] Chan, D. W. M and Kumaraswamy, M. M (1996). A comparative study of causes of time overruns in Hong Kong construction projects” *International Journal of Project Management*, Vol 15 (1), pages: 55–63
- [23] Frimpong, Y., Oluwoye, J. and Crawford, L. (2003). Causes of delays and cost overruns in construction of groundwater projects in developing countries; Ghana as a case study. *International Journal of Project Management*, Vol 21, pages: 321-326
- [24] Long, N. D; Ogunlana, S; Quang, T and Lam, K. C (2004). Large construction projects in developing countries: a case study from Vietnam, *International Journal of Project Management*, Vol. 22, pages: 553–561
- [25] Aibinu, A. A and Jagboro, G.O (2002). The effects of construction delays on project delivery in Nigerian construction industry, *International Journal of Project Management* Vol 20, pages 593–599
- [26] Memon, A. H; Abdul Rahman, I; Abdullah, M. R and Abdu Azis, A. A (2011). Assessing the Effects of Construction Delays on MARA Large Projects, *Proceeding of the International Conference on Advanced Science, Engineering and Information Technology*, Hotel Equatorial Bangi-Putrajaya, Malaysia, 14 – 15 January 2011
- [27] Lo, T., Fung, I. and Tung, K. (2006). Construction delay in Hong Kong civil engineering projects, *Journal of Construction Engineering and Management*, Vol 132 (6), pages: 636-49
- [28] Mezher, T.C. and Tawil, W. (1998). Causes of delay in the construction industry in Lebanon, *Engineering Construction and Architectural Management*, Vol. 5 (3), pages: 252-60.
- [29] Enshassi, A., Lisk, R., Sawalhi, I. and Radwan, I. (2008). Contributors to construction delays in Palestine, *The Journal of American Institute of Constructors*, Vol. 27 (2), pages: 45-53.
- [30] Ahmed, S.M., Azhar, S., Kappagantula, P. and Gollapudi, D. (2003). Delays in construction: a brief study of the Florida construction industry, *Proceedings of the 39th Annual Conference of the Associated Schools of Construction*, Clemson University, Clemson, SC (final report, Miami, FL).
- [31] Koushki, P. A., Al-Rashid, K and Kartam, N. (2005). Delays and cost increases in the construction of private residential projects in Kuwait. *Construction Management and Economics*, Volume 23 (3), Pages: 285-294
- [32] Kaming P.F; Olomolaiye P.O; Holt G.D and Harris F.C (1997). Factors influencing construction time and cost overruns on high-rise projects in Indonesia, *Journal of Construction Management and Economics*, Volume 15 (1), Pages: 83-94.
- [33] Chimwaso, K.D. (2001). *An Evaluation of Cost Performance of Public Projects; Case of Botswana*, Department of Architecture and Building Services, Gaborone.
- [34] Assaf, S.A and Al-Hejji, S (2006). Causes of delays in large construction projects, *International journal of project management*, Vol 24, pages: 349-357
- [35] Memon, A. H; Abdul Rahman, I; Abdullah, M. R and Abdu Azis, A. A (2010). Factors Affecting Construction Cost in Mara Large Construction Project: Perspective of Project Management Consultant. *International Journal of Sustainable Construction Engineering & Technology*, Vol 1 (2)
- [36] Odeh, A. M and Battaineh, H. T (2002). Causes of Construction delay: traditional Contracts.

- International Journal of Project Management, Vol 20, pages: 67–73
- [37] Ameh, O. J; Soyngbe, A. A and Odusami K. T (2010). Significant factors causing cost overruns in Telecommunication projects in Nigeria. *Journal of Construction in Developing Countries*, Vol 15
- [38] Enshassi, A., Al-Najjar, J. and Kumaraswamy, M. (2009). Delays and cost overruns in the construction projects in the Gaza Strip. *Journal of Financial Management of Property and Construction*, 14(2), pages: 126-151.
- [39] Kaliba, C., Muya, M. and Mumba, K. (2009). Cost escalation and schedule delays in road construction projects in Zambia. *International Journal of Project Management*, Vol 27, pages: 522-531.
- [40] Azhar, N., Farooqui, R. U. and Ahmed, S. M. (2008). Cost overrun factors in construction industry in Pakistan. *Proceeding of first international conference on construction in developing countries (ICCIDE-1)*, Karachi, Pakistan, 4-5 August. 499-508. [www.neduet.edu.pk/Civil/ICCIDC-1/...papers/051.pdf](http://www.neduet.edu.pk/Civil/ICCIDC-1/...papers/051.pdf)
- [41] Latif, Y; Abidin, I and Trigunarsyah, B (2008). Knowledge-based Material Cost Control for Building Construction Project using Expert System Approach. In Haigh, Richard and Amaratunga, Dilanthi, Eds. *Proceedings CIB International Conference on Building Education and Research*, pages: 1969-1978, Heritance Kandalama, Sri Lanka
- [42] Oladapo, A. A (2007). A quantitative assessment of the cost and time impact of variation orders on construction projects" *Journal of Engineering, Design and Technology*, Vol. 5 (1), pages: 35-48
- [43] Moura, H. P; Teixeira, J.C and Pires, B (2007). Dealing With Cost and Time in the Portuguese Construction Industry, *CIB World Building Congress*; pages: 1252-1265
- [44] Omoregie, A and Radford, D. (2006). Infrastructure delays and cost escalation: causes and effects in Nigeria. *Proceeding of sixth international postgraduate research conference*, Delft University of Technology and TNO, the Netherlands. 3rd-7th April.
- [45] Harisweni (2007). *The Framework for Minimizing Construction time and Cost Overruns in Padding and Pekanbaru, Indonesia*, A thesis submitted in fulfilment of the requirements for the award of the degree of Master of Science (Quantity Surveying), Faculty of Built Environment, Universiti Teknologi Malaysia
- [46] Creedy, G. D; Skitmore, M and Wong, J. K. W (2010). Evaluation of Risk Factors Leading to Cost Overrun in Delivery of Highway Construction Projects. *Journal of Construction Engineering and Management*, Vol. 136 (5), Pages: 528–537
- [47] Chang, A. S. T (2002). Reasons for cost and schedule increase for engineering design projects. *Journal of Management in Engineering*, ASCE, Vol 18 (1), pages: 29–36.
- [48] Jackson, S. (2002). Project cost overrun and risk management. in Greenwood, D. (Ed.) *Proceedings of Association of Researchers in Construction Management 18th Annual ARCOM Conference*, Newcastle, Northumber University, UK, 2-4 September <http://icrcreading.org/publications/Project%20cost%20overruns%20and%20risk%20management%20ARCOM%202002.pdf>
- [49] Jackson, O and Steven, O (2001). *Management of Cost Overrun in Selected Building Construction Project in ILOZRIN. Review of Business and Finance*, Volume 3 (1)
- [50] Achuen, E and Kolawole, J. O (1998). Assessment and Modelling of Cost Overrun of Public Building Projects in Nigeria. *Nigerian Journal of Construction Technology and Management*, Vol 1 (1), pages: 11-15
- [51] Al-Juwairah, Y. A. *Factors Affecting Construction Costs in Saudi Arabia*", Thesis of MSc in construction Management, Faculty of the college of Graduate Studies, King Fahad University of Petroleum & Minerals Dhahran, Saudi Arabia
- [52] Morris, S. (1990). Cost and time overruns in public sector projects. *Economic and Political Weekly*, No. 47, pages: 154-68.
- [53] Majid, I. A. *Causes and Effects of delays in ACEH Construction Industry*, Thesis of MSc in construction management, Faculty of Civil Engineering, University Technology Malaysia
- [54] Fugar, F. D. K and Baah, A. B. A (2010). Delays in Building Construction Projects in Ghana, *Australasian Journal of Construction Economics and Building*, Vol 10 (1)
- [55] Al-Kharashi, A and Martin, S (2009). Causes of delays in Saudi Arabian public sector construction projects" *Construction Management and Economics*, 27(1), pages: 3-23
- [56] Tumi, S. A.H; Omran, A and Pakir, A. H. K (2009). Causes of delay in construction industry in Libya. *The International Conference on Economics and Administration (ICEA)*, Faculty of Administration and Business, University of Bucharest, Romania
- [57] El-Razek; M. E. A; Bassioni, H.A and Mobarak, A. M (2008). Causes f delay in Building Construction Projects in Egypt, *Journal of Construction Engineering and Management*, Vol. 134 (11), pages: 831-841

- [58] Yang, Y. B and Shen-Fen Ou, S. F (2008). Using structural equation modeling to analyze relationships among key causes of delay in construction. *Canadian Journal of Civil Engineering*. Vol 35, pages: 321–332
- [59] Sweis, G, Sweis, R, Hammad A. A and Shboul, A (2008). Delays in construction projects: The case of Jordan. *International Journal of Project Management*, Vol 26, Pages: 665-674
- [60] Mok, K. Y; Yong, K. S and Van, L. T (2008). Causes of construction delays of apartment construction projects: comparative analysis between Vietnam and Korea, *Korean Journal of Construction Engineering and Management*, Vol 9 (5), pages: 214-226
- [61] Alaghbari, W; Kadir, M. R. A; Salim, A and Ernawati (2007). The significant factors causing delay of building construction projects in Malaysia. *Engineering, Construction and Architectural Management* Vol. 14 (2), pages: 192-206
- [62] Aibinu, A. A and Odeyinka, H. A (2006). Construction Delays and Their Causative Factors in Nigeria” *Journal of Construction Engineering and Management* Vol 132 (7), pages: 667– 677
- [63] Acharya, N. K; Lee, Y. D; Kim, S. Y; Lee, J. C and Kim, C. S (2006). Analysis of Construction Delay Factor: A Korean Perspective. *Proceedings of the 7th Asia Pacific Industrial Engineering and Management Systems Conference* Bangkok, Thailand
- [64] Acharya, N. K; Lee, Y. D and Im, H. M. Investigating delay factors in construction industry: A Korean perspective”, *Korean Journal of Construction Engineering and Management*, Vol 10, pages: 177-90
- [65] Alwi. S and Hampson. K (2003). Identifying the important causes of delays in building construction projects. *Proceedings the 9th East Asia-Pacific Conference on Structural Engineering and Construction*, Bali, Indonesia
- [66] Al-Tabtabai, H. M (2002). Causes for delays in construction projects in Kuwait. *Engineering Journal of University of Qatar*, Vol 15, pages: 19-37
- [67] Ogunlana, S. O and Promkuntong, K (1996). Construction delays in a fast-growing economy: Comparing Thailand with other economies” *International Journal of Project Management* 14 (1) 37–45
- [68] Yates, J. K (1993). Construction Decision Support System for Delay Analysis. *Journal of Construction Engineering and Management*, Vol. 119 (2)
- [69] Amu, O. O and Adesanya, D. A (2011). Mathematical Expressions for Explaining Project Delays in Southwestern Nigeria”, *Singapore Journal of Scientific Research*, Vol 1 (1), pages: 59-67
- [70] Ghani, A (2006). The importance of Preliminaries Item. *Masters Degree, University Technology Malaysia, Skudai*
- [71] Abdullah MR (2010). Significant causes and effects of construction delay. *Master thesis, University Tun Hussein Onn Malaysia*