

Project Delay Factor Ranking among Contractor, Client and Project Management Consultant in Construction Industry

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Abstract — *A construction project delay can result in financial losses to various parties involved both to the Contractor, Client and Project Management Consultant (PMC). This paper presents the results of a survey questionnaire conducted among Contractors, Clients and PMC. Data was analyzed with statistical tools to rank factors that influenced construction delays. From the results of the analysis there were 58 project delay factors that affected the delay of construction projects based on previous research. The project delay factors ranked so as to produce a project delay ranking sequence. Project delay factors will be grouped based on the perception of the Contractor, Client and PMC. Each project delay factor will be analyzed based on the type of delay factor, namely: Finance; Technical; and Coordination. It is concluded that the type of delay factor "finance" is a problem causing the project delay according to the perception of the "Client". While the type of "Technical" delay factor is the dominant cause of involvement according to the Contractor and PMC. For the type of delay factor "Coordination" is the main consideration for the cause of the project delay for the Contractor.*

Keywords: *Delay factors, Contractor, Consultant, PMC, Construction.*

INTRODUCTION

The construction industry, one of the major industries in Indonesia as in other countries has contributed significantly to economic and social development growth. Targets for completing construction projects on time and in accordance with the financial budget and getting results that are in accordance with the quality standards determined are the main criteria in the success of a project (Male, 2008; Chan & Kumaraswamy, 1997; Rwelamila & Hall 1995) Although the government and the private sector have funded large amounts of funds for construction projects, the construction industry faces several challenges such as over-planned expenditure budgets, problems of late project completion, mistakes in building defects and dependence on technology and foreign workers. However, this study is focused on identify and rank factors that influence construction project delays based on the perceptions of the Contractor, Client and Project Management Consultant (PMC). The summary of the literature review in Table 1 in this study is based on previous research (Asmi, Djamaris & Ihsan 2019). Azhar et al. (2008) conducted an investigation into the delay in construction projects in Pakistan. Research studies were carried out using a questionnaire consisting of 42

factors showing that the 10 main factors in delay were fluctuations in "material prices"; "high costs for engine maintenance"; "too low supply"; "procedures for procurement of goods and materials"; "procurement phase"; "methods of improper cost estimates"; "additional work"; "improper planning"; "inadequate government policies".

Le-Hoai et al. (2008) investigated the causes of delays in construction projects in Vietnam using questionnaire surveys. Investigations involved 21 factors and 5 general factors including "field management and poor supervision"; "poor project management"; "financial difficulties from the owner"; "financial difficulties from contractors and design changes".

Enshassi et al. (2009) conducted a questionnaire study survey consisting of 42 factors to investigate the main causes of delays in construction projects in Gaza among contractors, consultants and clients. The results of the study show that the 10 main factors that cause delays received by 3 parties (contractors, consultants and clients) are increases in material prices, late construction, material and equipment supplies by contractors, fluctuations in construction material prices, exchange rates against the US dollar, monopoly of project material by several material providers, source constraints: funding and lack of preparation from related parties, lack of funds

in planning or supervision during the contract stages before and after, improvements to drawings during the construction phase, design changes and lack of accuracy in taking quantities material.

Kaliba et al. (2009) conducted a study to determine the contributors to the late construction of flat road construction projects in Zambia. The results of the study show that the main cause of delays is the change in construction costs caused by weather caused by heavy rains and floods, changes in the scope of work, protection of the environment and mitigation of costs, schedule delays, strikes from labor, technical challenges, inflation and local government pressure.

Ameh et al. (2010) investigated the causes of construction delays in 53 telecommunication projects in Nigeria through questionnaire surveys. The survey results show that 7 main factors are “inexperienced contractors”; “material prices”; “fluctuations in material prices”; “repeated design changes”; “economic stability” and “high interest rates on loans imposed on contractors”; “types of payments”; “loans and payments”.

DATA COLLECTION

Based on previous research (Asmi, Pratama & Safrilah 2016), this research study conducted a study by identifying several common factors that could cause delays in construction projects; and also carrying out a hierarchical assessment of the factors causing delays in construction projects in Jakarta. This study was carried out based on two research methodology approaches namely conducting a literature review mapping and questionnaire activity in a quantitative manner so that data collection would be more comprehensive based on factors of project construction delays that had been identified through literature review literature from previous studies. The structured questionnaire was designed and distributed randomly to get the ranking of research results.

While the other approach was by conducting a questionnaire survey to evaluate the frequency of possible events, the severity and the significance of the causes of the delay identified. Each delay factor is weighted according to the level of significance, as indicated by the respondent.

Tabel 1. Delay Factor Weightage

Weightage	Factor
5	Extremely Significant
4	Very Significant
3	Moderately Significant
2	Slightly Significant

The ranking of effects of construction delays is calculated based on the mean rank score. The higher the mean rank score shows the higher is the ranking.

The formula used for the mean rank calculation is as follow:

$$M_R = \frac{\bar{R}}{M_{max}}n \tag{1}$$

where M_R is Mean Rank, is Individual Mean Rank of effect, M_{max} is the Maximum Individual Mean Rank of effect and n is the number of effects. The determination of significance of effects is based on the mean rank scored.

RESULTS AND DISCUSSIONS

Major findings of the quantitative data analysis were that the main problems facing construction industry in Jakarta are the delay in the project. Project delay costs have increased sharply and have impacted on the initial costing of the project. A total number of 88 filled questionnaires were received, most of them were 61.4% (0-5 years of experience); 11% (6-10 years of experience); 9% (11-15 years of experience); 9% (16-20 years of experience); 4% (21-25 years of experience); 1% (More than 25 years of experience); Engineers (76.1%) followed by Consultant (11.4%), Project Manager (12.5%) and all the respondents were related to construction industry as shown in Table 2 and Table 3.

Table 2. Year of Experience

Category	Frequency	Percent	Cumulative Percent
0-5 years	54	61.4	61.4
6-10 years	11	12.5	73.9
11-15 years	9	10.2	84.1
16-20 years	9	10.2	94.3
21-25 years	4	4.5	98.9
> 25 years	1	1.1	100.0
Total	88	100.0	

Table 3. Classification of respondent by Position

	Project			Total
	Engineer	Consultant	Manager	
Frequency	67	10	11	88
Percent	76.1	11.4	12.5	100.0

The reliability test depicts the consistency degree of the data collected. The Cronbach α coefficient is a measure of the inner consistency. Reliability is in low level when Cronbach α is less than 0.3 and this condition cannot be accepted, however when Reliability is in high level when Cronbach α is more than 0.7, this calculation indicates inner consistency of indexes table in high level then this condition can be highly acceptable. Table 4 shows reliability analysis for this study and the results

indicate that Cronbach's Alpha is 0.973 which is in high level. However, there is a common agreement that the data is acceptable if the Cronbach α reaches 0.6 (Meepol & Ogunlana, 2006).

Table 4. Reliability Statistics

No of Cases	No of Variables	Cronbach's Alpha
88	58	0.973

The results of the study are ranked to find top significant factors causing delays in construction projects. Table 5 shows overall Project Delay Factors as cited by all respondents.

Table 5. Overall Project Delay Factors

Delay Factor	Mean	Std. Dev.	Ranking
Frequent design changes	3.93	1.11	1
Financial difficulties of owner	3.86	1.23	2
Delay in progress payment by owner	3.76	1.07	3
Incompetent subcontractors	3.70	1.00	4
Schedule delay	3.69	1.10	5
Poor design and delays in Design	3.65	1.08	6
Late delivery of materials and equipment	3.61	1.09	7
Labour productivity	3.60	1.10	8
Cash flow and financial difficulties faced by contractors	3.59	1.14	9
Lack of coordination between parties	3.58	0.93	10
Delay preparation and approval of drawings	3.58	0.94	11
Delay in material procurement	3.57	1.17	12
Mistakes and errors in design	3.56	1.21	13
Equipment availability and failure	3.56	1.09	14
Mistakes during construction	3.55	1.07	15
Changes in material specification and type	3.52	1.05	16
Impractical and complicated design	3.52	1.02	17
Incomplete design at the time of tender	3.51	1.07	18
Rework	3.50	1.14	19
Shortage of technical personnel (skilled labour)	3.49	1.01	20
Delay payment to supplier / subcontractor	3.48	1.02	21
Unrealistic contract duration and requirements imposed	3.47	0.99	22
Owner interference	3.43	1.01	23
Inaccurate time and cost estimates	3.42	1.05	24
Poor project management	3.41	1.07	25
Slow information flow between parties	3.40	0.84	26
Insufficient numbers of equipment	3.38	1.06	27

Delay Factor	Mean	Std. Dev.	Ranking
Lack of experience of technical consultants	3.38	1.00	27
Lack of communication between parties	3.36	0.91	29
Obsolete or unsuitable construction methods	3.35	0.99	30
Poor financial control on site	3.31	1.11	31
Shortage of site workers	3.30	1.12	32
Contractual claims, such as extension of time with cost claims	3.30	0.97	32
Poor contract management	3.30	1.12	32
Delay in inspection and approval of completed works	3.30	0.95	35
Delays in decisions making	3.28	1.02	36
Inadequate monitoring and control	3.26	0.95	37
Lack of constructability	3.26	1.11	38
Change in the scope of the project	3.25	0.95	39
Labor absenteeism	3.24	1.17	40
Inadequate planning and scheduling	3.23	1.03	41
Unforeseen ground condition	3.22	0.96	42
Mode of financing, bonds and payments	3.22	1.02	43
Inaccurate site investigation	3.20	1.02	44
Poor site management and supervision	3.18	1.05	45
Shortages of materials	3.18	1.11	46
Omissions and errors in the bills of quantities	3.18	1.09	46
Severe overtime	3.09	0.92	48
Additional works	3.08	1.01	49
Fluctuation of prices of materials	3.06	1.20	50
Effect of weather	3.05	1.13	51
Inaccurate quantity take-off	3.00	0.83	52
Lack of experience	2.99	1.02	53
High cost of labor	2.97	1.10	54
Number of construction going on at same time	2.91	0.89	55
High cost of machinery and its maintenance	2.85	1.00	56
Bureaucracy in tendering method	2.80	1.03	57
Waste on site	2.63	0.97	58

Then from the results of the ranking of Table 5 studies, the top 10 Project Delay Factors are taken based on the perception of Contractors, Clients and PMC as can be seen in Table 6, Table 7 and Table 8. For each delay factor, three categories will be given, namely: "Finance"; "Technical"; and "Coordination".

Table 6. Top 10 Project Delay Factors Contractors Perception

Type	Delay Factor	Contractor
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		Mean ¹	Std. Dev.	Rank
Finance	Financial difficulties of owner	3.80	1.35	1
Technical	Frequent design changes	3.79	1.20	2
Technical	Incompetent subcontractors	3.71	1.12	3
Coordination	Labor productivity	3.70	1.16	4
Technical	Poor design and delays in Design	3.70	1.22	5
Coordination	Late delivery of materials and equipment	3.68	0.99	6
Finance	Delay in progress payment by owner	3.63	1.12	7
Coordination	Equipment availability and failure	3.63	1.07	8
Coordination	Delay in material procurement	3.63	1.17	9
Coordination	Schedule delay	3.63	1.24	10

As the Table 6, there are 10 project delay factors which are factors that cause delays in construction projects. There are four dominant factors causing delay based on the Contractor's perception. The "Financial difficulties of owner" factor is the main factor for the contractor's problem. This can illustrate that contractors often face delays due to these factors. In addition, the factor "Frequent design changes" is the second factor considered by the contractor due to frequent design changes from the owner / client. The "Incompetent Subcontractors" factor is a constraint for the contractor's delay in supporting the progress of the project. So it is necessary to choose a subcontractor that has a good track record for the smooth running of the project from the main contractor and this can be done through a screening process. The "Labor productivity" factor is a problem for contractors because contractors always face labor or human resource management problems.

Table 7. Top 10 Project Delay Factors based on Client perception

Type	Delay Factor	Client		
		Mean ²	Std. Dev.	Rank
Finance	Delay payment to supplier / subcontractor	4.38	0.72	1
Finance	Poor financial control on site	4.19	0.83	2
Finance	Cash flow and financial difficulties faced by contractors	4.13	0.96	3
Finance	Delay in progress payment by owner	4.13	0.81	4
Technical	Frequent design changes	4.13	0.89	5
Coordination	Owner interference	4.00	0.82	6

Type	Delay Factor	Client		
		Mean ²	Std. Dev.	Rank
Finance	Financial difficulties of owner	4.00	0.89	7
Coordination	Delay in material procurement	4.00	1.10	8
Coordination	Changes in material specification and type	3.94	1.00	9
Coordination	Unrealistic contract duration and requirements imposed	3.94	0.68	10

Based on Table 7, there are four highest factors that influence project delays based on Client perceptions. "Delay payment to supplier / subcontractor" is a factor that greatly influences project delays based on Client perceptions. Late payment from the main contractor to the supplier / subcontractor affects the delay of other construction activities because the cash flow from the supplier / subcontractor will be disrupted. The "Poor financial control on site" factor is the second highest dominant cause based on Client perception. Then the factor "Cash flow and financial difficulties faced by contractors" became the third position causing the project delay. While the "Delay in progress payment by owner" factor is the fourth dominant factor in project delays based on Client perceptions

Table 8. Top 10 Project Delay Factors PMC versions

Type	Delay Factor	PMC		
		Mean ³	Std. Dev.	Rank
Technical	Frequent design changes	4.25	0.9	1
Finance	Cash flow and financial difficulties faced by contractors	3.94	1.1	2
Finance	Financial difficulties of owner	3.94	1.1	3
Finance	Delay in progress payment by owner	3.88	1.1	4
Coordination	Schedule delay	3.81	0.8	5
Coordination	Mistakes during construction	3.75	1.0	6
Technical	Impractical and complicated design	3.63	1.1	7
Coordination	Additional works	3.63	1.1	8
Coordination	Owner interference	3.56	1.0	9
Technical	Incompetent subcontractors	3.56	0.7	10

Based on Table 8, there are four dominant factors that influence delays in which "Frequent design changes" are the highest project delay factors according to the contractor's perception. The dominant factors followed by the "Cash flow and financial difficulties faced by contractors" factor and the "Financial difficulties of owner" factor and the "Delay in progress payment by owner" factor.

Based on Tables 6, 7 and 8 above, project delay factors are grouped by type of category as in Table 9 below.

Table 9. Type of Project Delay Factors

Type of Category	Project Delay Factors		
	Contractor	Client	PMC
Finance	2	5	3
Technical	3	1	3
Coordination	5	4	4

From the results of the Table 9 above, it can be seen that for the project delay factor due to problems with the type of category "Finance" is the dominant factor in the Client's view (5 factors). While the second ranked is the PMC with 3 project delay factors and the Contractor with 2 project delay factors. For the project delay factor caused by problems with the type of category "Technical" is the dominant factor in the view of the Contractor and PMC (3 factors). This is considered important by the Contractor and PMC because the type of "technical" category is the key to the success of a construction project. On the other hand, the type of "Technical" category in the Client's view is not a dominant factor in project delays and the tendency of the Client is to consider the issue of "Finance". From the results of the Table above, the type of category "Coordination" becomes the dominant factor considered by the Contractor (5 project delay factors) because the Contractor as the project implementing party requires coordination in their daily lives. In comparison, in terms of the Client and PMC perception, the "Coordination" factor is rated by 4 project delay factors in second place after the Contractor. Furthermore, overall the "Coordination" factor is a very important factor for Contractors, Clients and PMCs because the difference in the number of project delay factors is not much different.

CONCLUSION

The four main causes of overall construction project delays are the "Frequent design changes" factor; "Financial difficulties of owner"; "Delay in progress payment by owner"; "Incompetent subcontractors". As for the contractor's perception, the four main causes of project delays consist of: "Financial difficulties of owner"; "Frequent design changes"; "Incompetent subcontractors"; "Labor productivity". Based on the analysis of client perceptions, the four dominant causes of project delay are: "Delay payment to supplier / subcontractor"; "Poor financial control on site"; "Cash flow and financial difficulties faced by contractors"; "Delay in progress payment by owner". In addition, as for PMC perceptions, there are four main factors causing delays in construction projects, namely: "Frequent design

changes"; "Cash flow and financial difficulties faced by contractors"; "Financial difficulties of owner"; "Delay in progress payment by owner". However, different issues concluded for the causes of project delays based on the types of Finance, Technical and Coordination categories, the Client strongly considers the issue of "Finance" to be the dominant cause for project delays. Meanwhile, for the type of category "Technical", the Contractor and PMC stated that the type of category "Technical" is a very influential factor for project delays. In addition, for the type of "Coordination" category is the type of delay factor category that is very important for the Contractor as the main cause of project delay compared to the perception of the Client and PMC.

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