

Identifying the Most Influential Construction Management Tasks in Improving the Construction Performance of High-Rise Building Projects in Jakarta

Lusiana Idawati*, Manlian Ronald A. Simanjuntak **, Lukman Afif***

* Lecturer of Master Program in Civil Engineering Construction Management Faculty of Science and Technology - Universitas Pelita Harapan, Indonesia

** Professor of Construction Management at Pelita Harapan University. Chairman of the Master Program in Civil Engineering Construction Management Faculty of Science and Technology Universitas Pelita Harapan, Indonesia.

*** Master Program in Civil Engineering Construction Management Faculty of Science and Technology Universitas Pelita Harapan, Indonesia

Abstract – As a growing metropolitan city, Jakarta has to provide for the growing needs of its inhabitants for facilities and city infrastructures. Facing the fact that land for new constructions is limited, the construction of high-rise buildings becomes one of the most possible alternatives. However, the construction of high-rise buildings is more complicated compared to low-rise buildings in general. Considering the complexities and the impact of the construction to its environment, most high-rise building owners prefer to utilize the service of a construction management consultant to ensure the performance of the construction project, as measured in time, cost, or design specification.

This research aims to analyze the role of construction management (CM) consultants in improving the construction performance of high-rise building projects in Jakarta, with a specific objective to identify the tasks of CM consultants that most significantly influence the projects' performance. This research was started with literature study followed by field study to collect primary data from respondents. Data collected from questionnaires completed by the respondents then processed and analyzed using SPSS with regression method.

It is expected that the findings of this research would give a better understanding about the role of CM consultants in improving the performance of high-rise building construction projects in Jakarta. Recommendations given as the result of this research are expected to be beneficial for all parties involved in the high-rise building construction projects – especially building owners and CM consultants – in Jakarta or other similar areas.

Index Terms-Construction Management, Construction Management Tasks, Construction Project Performance, High-Rise Building, Jakarta.

I. INTRODUCTION

As the capital of Indonesia, Jakarta is growing fast, in the number of its inhabitants as well as the variety of activities it has to accommodate. The growing need for buildings increase the price of land in Jakarta, not only in the business centers, but also in the residential areas. With these facts, vertical building, especially high-rise building, becomes a reasonable option for both the government – in providing facilities for the various activities of its inhabitants – and building owners – as a solution to the limitation related to construction site, either the available area or the cost of the land.

High-rise building, however, has its own uniqueness and challenges compared to one-story or low-rise buildings. It is considered more complex and has bigger and broader impact, financially and environmentally. To better manage the project and control potential risks, most owners choose to employ construction management (CM) consultants. The CM consultants are teams that have specific skills in managing a construction project. They plan, monitor, control, and involved in the implementation or execution of the plan. Therefore, CM consultants have a significant role in determining the success of a project.

The task of CM consultant is to accompany and advise its client from the beginning phase of the project (concept and feasibility study), prepare the next phase (design and engineering), control the construction phase, and monitor until the next phases: operational and utilization. In general, the job description of a CM consultant can be briefly explained as translating the owner's needs and aspirations into the design, construction, and utilization of the building. This is done by accompanying the design consultant in the design process, and supervising and accompanying the contractor in the construction phase.

So it is clear that, for the owner, the main purpose of utilizing the services of a CM consultant is to improve the performance of the project – measured in time, cost, and quality or specifications of the project – by implementing a good administration system. If the role of the CM consultants is played fully without compromising the standards, it is expected that the objective can be achieved well. However, preliminary observation – from literature, previous researches, and direct observation in high-rise building projects – showed that a lot of construction projects in which CM consultants were involved still faced problems with its time, cost, and quality performance.

This phenomenon has attracted the interest of the researchers to analyze how CM consultants' role in high-rise building projects can improve the performance of the project. More specifically, which of the various tasks of the CM consultants that most significantly influence the construction performance of high-rise building projects in Jakarta. The research's results are expected to benefit the

parties involved in the whole construction process, especially the owners and CM consultants, in improving the performance of high-rise building projects in Jakarta, and also in other cities having similar problems and condition.

Research problem is stated as follows: to identify the tasks within the role of CM consultants during the construction phase of high-rise building projects, analyze the impact of the CM consultants' involvement in high-rise building projects during the construction phase to the projects' performance, and identify which of the tasks that are most significantly influence the projects' performance. The scope of this research is set as follows: the tasks of CM consultants studied is only the ones performed during the construction phase, projects studied are only high-rise building projects in Jakarta.

II. LITERATURE REVIEW

1. Construction Management

The Construction Management Association of America (CMAA) defines construction management (CM) as “a service that uses specialized, project management techniques to manage the planning, design, and construction of a project, from its beginning to its end.” It also clarify that “the purpose of CM is to control a project's time, cost and quality” (CMAA, 2007).

Even though the construction managers do not perform the actual construction tasks within the projects' life cycle, they have an important role to control the project's time, cost, and quality. To do this, the CM team – consists of specialists in different aspects of construction project management – systematically applies the full range of management function – plan, do, control, act – in the project under their responsibility with an objective to optimally achieve the project's goal and purposes.

Over the years, the role of CM has grown along with the development of the construction industry and became more complex just as the projects they manage. This development requires new approaches and studies in the area of construction management in order to cope with the industry's changes and keep its effectiveness in performing its role.

2. The Role and Tasks of Construction Management

In its publication, An Owner's Guide to Construction Management, CMAA (2007) explains that the role and responsibility of CM includes effective budgeting, better control of work scope, optimizing project scheduling options, best use of the project team's individual skills, avoid delays, changes, and claims as much as possible, improve quality of design and construction, and optimizing flexibility in supplier contract options.

During the construction phase, CM must focus on improving and expediting the construction process through professional planning and monitoring. The goal is the success of the project, i.e. optimized cost, time, and quality of the project. It is important that before the construction phase is started the CM has developed a complete construction management plan and procedures that specify clearly the roles, responsibilities, and authorities of each of project's teams during construction.

The following table shows the roles and tasks of Construction Management in the construction phase, summarized from CMAA (2010), PMBOK (2013), DKI Jakarta government's standard CM contract for high-rise building, and previous researches: Iranie (2011), Widiyanti and Lenggogeni (2013), and Idawati, Simanjuntak and Kurniawan (2016).

The following is tables of the roles and tasks of Construction Management in the construction phase of a construction project taken from several literature:

Table 1. Roles and tasks of Construction Management in the construction phase

Integration Management	
X1	<i>Pre-construction meeting</i>
X2	Leading and performing the work defined in the project management plan and implement approved changes to achieve the project's objectives
X3	Tracking, reviewing, and reporting project progress against the performance objectives defined in the project management plan
X4	Reviewing all change requests; approving changes and managing changes to deliverables, organizational process assets, project documents, and the project management plan; and communicating their disposition
X5	Direct and coordinate each of the professionals and contractors in fulfilling the project's requirements
X6	Finalizing all activities across all of the Project Management Process Groups to formally complete the phase or project
X7	Coordinate all drawings in every scope of works provided by the design consultants
X8	Monitor the record drawing process monthly during construction
Scope Management	
X9	Monitoring the status of the project and product scope and managing changes to the scope baseline
X10	Identify long lead materials and equipment, and coordinates scheduling, on-site delivery, and installation and start-up requirements for these material and equipment
X11	Survey the site situation, work space distribution and construction area arrangement to provide construction plan
X12	Record and review all extra and/or additional work submitted by contractor
X13	Supervise the quantity of work parts according to contract
X14	Verify that office facilities and site work required for general acces and utilities to all on-site organizations are provided
Time Management	
X15	<i>Preliminary schedule</i>

X16	Inform, adjust, and distribute master schedule
X17	Monitoring the status of project activities to update project progress and manage changes to the schedule baseline to achieve the plan
X18	Report early about possibilities of delays and propose solutions to prevent or handle the delays
X19	Propose to the owner things that have to be done in order to assure that work duration is achieved or accelerated while maintaining the quality of work
X20	Schedule short term work activities
X21	Schedule report
Cost Management	
X22	Perform component studies on materials, systems, equipment, and accessories, to ensure that economical and competitive components are selected consistent with the construction budget
X23	Progress Payment
Quality Management	
X24	Auditing the quality requirements and the results from quality control measurements to ensure that appropriate quality standards and operational definitions are used
X25	Monitoring and recording results of executing the quality activities to assess performance and recommend necessary changes
X26	Assist the owner in managing and controlling field work
X27	Supervise quality of materials, workforce, cost, including tools/equipment test, work methods and results to meet contract
X28	Give directions to contractor about work methods and other related things in order to assure work quality and smoothness
X29	Plan and coordinate field tests
X30	Review design to verify consistency with design criteria, regulatory requirements and constructability consideration
X31	Final inspection and punch list
X32	Monitor the acceptance and and performance testing to see that it is conducted in accordance with contract requirements
X33	Issue final completion certificate
X34	Give advises on regulatory conditions that are not written in the contract documents
Human Resource Management	
X35	Confirming human resource availability and obtaining the team necessary to complete project activities
X36	Improving competencies, team member interaction, and overall team environment to enhance project performance
X37	Tracking team member performance, providing feedback, resolving issues, and managing changes to optimize project performance
X38	Put project supervisors continuously during construction until hand over
Communication Management	
X39	Creating, collecting, distributing, storing, retrieving and the ultimate disposition of project information in accordance with the communications management plan
X40	Monitoring and controlling communications throughout the entire project life cycle to ensure the information needs of the project stakeholders are met
X41	Progress meeting and special meeting
X42	Write and submit monthly report, CM report, and final report to the owner
X43	Responsibility for establishing a management reporting system to keep the various team members informed on project status
X44	Write warning letters about inappropriate works and provide solution to the problem
Risk Management	
X45	Implementing risk response plans, tracking identified risks, monitoring residual risks, identifying new risks, and evaluating risk process effectiveness throughout the project
X46	Review data collected from preliminary site visit to assess sufficiency of the information on existing condition and any additional information
X47	Prepare project health and safety program
Procurement Management	
X48	Review and follow up sufficiency and completeness of contract documents
X49	Managing procurement relationships, monitoring contract performance, and making changes and corrections as appropriate
X50	Completing each project procurement
X51	Monitor and control procurement of important building equipments to assure it comes on time according to contract
Stakeholder Management	

X52	Communicating and working with stakeholders to meet their needs/expectations, address issues as they occur, and foster appropriate stakeholder engagement in project activities throughout the project life cycle
X53	Monitoring overall project stakeholder relationships and adjusting strategies and plans for engaging stakeholders
	Contract administration
X54	Permit, insurance, labor affidavits, and bonds
X55	Field reporting
	Safety Management
X56	Emergency response coordination
X57	Compliance agencies
X58	Contractor safety enforcement and compliance
X59	Safety coordination meetings
X60	Safety committee
X61	Safety audit
X62	Provide monthly report to the owner containing the status of the program and of accident frequency and severity
	Sustainability
X63	Pre-Construction conference
X64	Construction planning and scheduling related to sustainability
X65	Inspection and testing consistent with the project management plan
X66	Reports and recordkeeping
X67	Request for information about sustainability

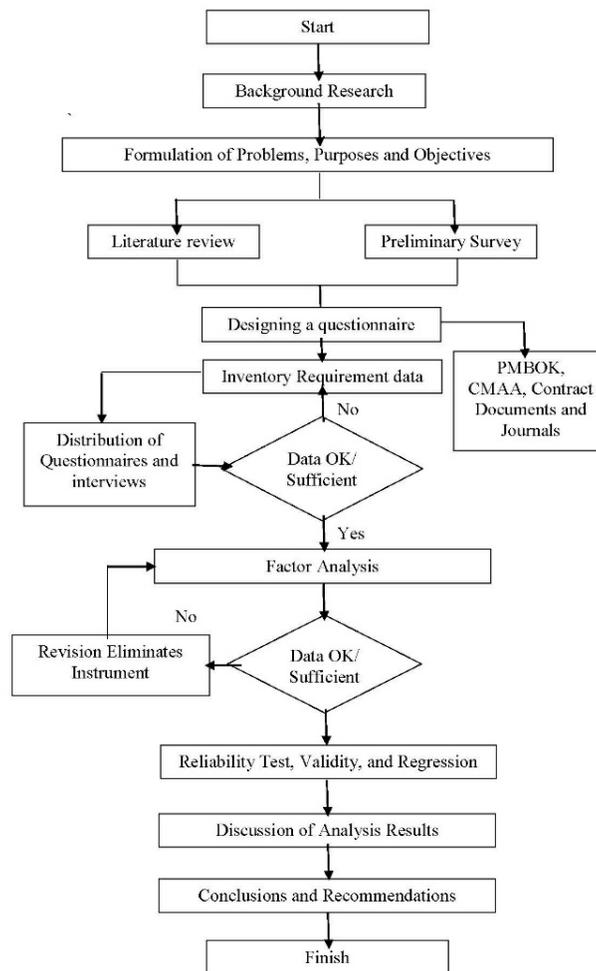
III. RESEARCH METHODOLOGY

The tasks of CM according to its role, as elaborated in table 1, provides the independent variables for the research. The independent variable is the project performance. These variables are arranged in a questionnaire and distributed to eligible respondents, that is, construction professionals having knowledge and experience in high-rise building projects in Jakarta. Selection of respondents are based on work experience, job position, and educational background. Data collected from questionnaires completed by the respondents then statistically processed using SPSS.

Correlation analysis are done to measure the level of relationship between independent variables to the independent variable. The correlation factor, r , shows the level of relationship and varies from 0 to 1 or -1, with 0 shows no correlation, 1 perfect positif correlation, and -1 perfect negative correlation. Intercorrelation analysis is conducted to check the presence of strong linear correlation among independent variables.

Factor analysis is employed to find factors that are able to explain the relationship of different independent variables observed. Variables grouped in a factor have a relatively strong correlation with other variables within the factor and relatively weak correlation with variables in other factors.

Reliability test is then performed to measure the internal consistency, hat is, how closely related a set of items are as a group. The coefficient of reliability or consistency is expressed in standardized Cronbach's alpha. Regression analysis is then conducted, to find the relationship between or influence of the independent variables to the independent variable. The research method and stages is presented in picture 1.



Picture. 1 Research Design

IV. ANALYSIS AND DISCUSSION

Questionnaires were distributed to 49 respondents, and 33 or 67% were completed. This showed a good participation level. All respondents were construction professional with work experience in high-rise building projects in Jakarta. Respondents' choices of answers in the questionnaire provide inputs on their perception about the tasks performed by CM and their impact to the project's performance.

Most respondents (63.64%) were project managers, while 30.30% were site managers and 6.06% were operational directors. Most of them held a bachelor degree (81.82%), while 9.09% diploma-3 degree, 6.06% masters' degree, and 3.03% graduated from senior high school. Most of the respondents (42.42%) had worked in construction projects for 11-15 years, while 27.27% 5-10 years, 21.21% 16-20 years, and 9.09% over 20 years. These facts about the respondents showed that all respondents of this research held a significant position in their job, were well educated and had significant work experience in construction projects, ensuring the respondents capabilities of providing sound information through the research questionnaires.

Based on the project location, most respondents worked in construction projects in South Jakarta (54.55%), while 21.21% in West Jakarta, 12.12% in Central Jakarta, 9.09% in East Jakarta, and 3.03% in North Jakarta. Construction projects consisted of buildings with 21-30 stories (42.42%), 13-20 stories (33.33%), 8-12 stories (18.18%), and more than 31 stories (6.06%). The buildings function as office (30.30%) apartment (21.21%), hotel (12.12%), shopping mall (9.09%), while the others (15.15%) function as mixed use, hospital, and other functions.

The research questionnaire consisted of 67 independent variables and 1 dependent variable. After correlation and intercorrelation tests, 19 independent variables were selected to be analyzed further using factor analysis. Four stages of tests were performed, including KMO and Bartlet, matrix anti image, total variance explained, and component matrix. All 19 variables met the requirements and qualified for further analysis. There were 5 factors identified: 1) component I consisted of X18, X36, X45, X38,

X24, X14; 2) component II consisted of X5, X13, X44, X12, X52, X43; 3) component III consisted of X50, X67, X48, X14; 4) component IV consisted of X48, X42, X43, X9; and 5) component V consisted of X9, X3, and X33.

Reliability test performed to the five factors gave results as follows: components I and II had very high reliability (Cronbach's alpha 0.814 and 0.845); components III, IV and V had high reliability or consistency with Cronbach's alpha of 0.752, 0.717 and 0.699. All components were qualified for regression analysis.

The regression analysis resulted in 6 independent variables that significantly influence the dependent variable. Those independent variables were: 1) review and follow up sufficiency and completeness of contract documents (X48); 2) control changes of project scope (X9); 3) report early about possibilities of delays and propose solution and steps that have to be taken to avoid or handle delays, e.g. schedule revision (X18); 4) completing each project procurement (X50); 5) communicate and work with stakeholders to meet their needs/expectations, address issues as they occur, and foster appropriate stakeholder engagement in project activities throughout the project life cycle (X52); and 6) request for information about sustainability (X67).

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.664 ^a	.441	.423	.42966
2	.765 ^b	.585	.558	.37633
3	.815 ^c	.664	.629	.34453
4	.867 ^d	.751	.715	.30186
5	.892 ^e	.796	.758	.27813
6	.908 ^f	.825	.784	.26264

a. Predictors: (Constant), VAR00048

b. Predictors: (Constant), VAR00048, VAR0009

c. Predictors: (Constant), VAR00048, VAR0009, VAR00018

d. Predictors: (Constant), VAR00048, VAR0009, VAR00018, VAR00050

e. Predictors: (Constant), VAR00048, VAR0009, VAR00018, VAR00050, VAR00052

f. Predictors: (Constant), VAR00048, VAR0009, VAR00018, VAR00050, VAR00052, VAR00067

Regression analysis results showed that together the 6 variables had significant positive impact to the performance of the project and could explain changes in the independent variables with 78.4% contribution (adjusted R square). The regression model is as follows:

$$Y = -0,117 + 0,219 X48 + 0,236 X9 + 0,306 X18 + 0,264 X50 + 0,224 X52 - 0,187 X67$$

The coefficient of variable X48 (review and follow up sufficiency and completeness of contract documents) is 0,219 which means X48 determinant variable have positive effect to change project performance, variable X9 (control changes of project scope) is 0,236 which means X9 determinant variable have positive effect to change project performance, Variable X18 (report early about possibilities of delays and propose solution and steps that have to be taken to avoid or handle delays, e.g. schedule revision) is 0,306 which means X18 determinant variable have positive effect to change project performance, Variable X50 (completing each project procurement) is 0,264 which means X50 determinant variable have positive effect to change project performance, Variable X52 (communicate and work with stakeholders to meet their needs/expectations, address issues as they occur, and foster appropriate stakeholder engagement in project activities throughout the project life cycle) is 0,224 which means X52 determinant variable have positive effect to change project performance, Variable X67 (request for information about sustainability) is 0,187 which means X67 determinant variable have positive effect to change project performance,

CM task in reviewing and following up the sufficiency and completeness of contract documents (X48) contributed 42.3% of changes in project performance in the regression model, with $t=2.768$ (>1.70329) and significance 0.010 (>0.05). CM task in controlling the project's scope (X9) contributed 13.5% with $t=2.875$ and significance 0.008 (<0.05).

Early report to owner about possibilities of delays and provide solutions to avoid or handle delays (X18) became the third task of CM used in the regression model that contributed 7.1% to the changes, with $t=3.954$ and significance 0.001 (<0.05). The task

of CM to complete every procurement of the project (X50) contributed 9% to changes in the dependent variable, with $t=4.088$ and significance 0.000 (<0.05).

Communication and team work with all project stakeholders during the project life cycle (X52) contributed 4.3% with $t=3.026$ and significance 0.006 (<0.05). Requesting additional information about project's sustainability (X67) contributed 2.6% with $t=2.068$ and significance 0.049 (<0.05).

V. CONCLUSION

The role of CM is perceived by the respondents as significant in improving the performance of high-rise building projects in Jakarta. Of the 67 tasks of CM used in this research, 6 were considered as having the most significant influence on the performance of high-rise building project in Jakarta, especially during the construction phase.

The 6 CM tasks that build the linear regression model are: 1) review and follow up sufficiency and completeness of contract documents (X48); 2) control changes of project scope (X9); 3) report early about possibilities of delays and propose solution and steps that have to be taken to avoid or handle delays, e.g. schedule revision (X18); 4) completing each project procurement (X50); 5) communicate and work with stakeholders to meet their needs/expectations, address issues as they occur, and foster appropriate stakeholder engagement in project activities throughout the project life cycle (X52); and 6) request for information about sustainability (X67).

Two of the 6 CM tasks are related to procurement management – X48 and X50 – with a significant contribution to the explanation of changes in independent variable, so it can be inferred that procurement management plays a significant role in improving the performance of high-rise building projects in Jakarta. Therefore, giving more attention to CM tasks in its role in procurement management and performing those tasks better may also improve the performance of high-rise building projects in Jakarta. However, this research has its own limitations, i.e. the projects and respondents were limited, as well the time and budget to conduct the research. Therefore, it is advised that further researches within this area may be conducted, in order to get a better and more complete understanding about the tasks of CM in improving project performance.

VI. RECOMMENDATION

The research findings provide recommendations, especially for owners and CM consultants, to improve construction performance in the future projects, especially high-rise buildings constructed in Jakarta. The recommendations are as follows:

1. CM needs to be more detailed in reviewing, planning, and explaining construction contracts documents, including the completeness of drawings, contract clauses, and clarity of wordings.
2. Scope of work and other things related to scope must be explained and clarified in details, and recorded in written documents. Changes in scope of work must be anticipated so as to ensure that project performance is not compromised.
3. Control of schedule must become the focus of everyone responsible for the project. Control can be done through identification, analysis, providing solutions, as well as developing easy and clear system to avoid delays in the construction phase.
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VIII. Authors

First Author – Lusiana Idawati, Lecturer of Master Program in Civil Engineering Construction Management Faculty of Science and Technology, Universitas Pelita Harapan, Indonesia. lusiana.idawati@uph.edu

Second Author – Manlian Ronald A. Simanjuntak, Lecturer of Master Program in Civil Engineering Construction Management Faculty of Science and Technology, Universitas Pelita Harapan, Indonesia. manlian.adventus@uph.edu.

Third Author – Lukman Afif, Master Program in Civil Engineering Construction Management Faculty of Science and Technology Universitas Pelita Harapan, Indonesia, lukmanafif24@yahoo.com