



Modeling Project Characteristics on Construction
Project Performance Based on Time Cost and
Quality in Pt XYZ Regional Jabodetabek

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MODELING PROJECT CHARACTERISTICS ON CONSTRUCTION PROJECT PERFORMANCE BASED ON TIME COST AND QUALITY IN PT XYZ REGIONAL JABODETABEK

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ABSTRAK

PT XYZ is a railway transportation company. Many construction projects are implemented to support its business in Jabodetabek. The construction projects in the Jabodetabek are carried out with different characteristics and influenced by many variables. While the owner (PT XYZ) want that the aspects of project performance are achieved. Project performance can be measured from many things such as cost, quality, social impact, etc. The purpose of this study are to identify and modeling characteristics project to performance based on time cost and quality. Literature review from previous study and expert discussion are methode to find variables and indicators. this study finds that project characteristics have correlation to project performances. Furthermore, project characteristics variable are consist of project implementation system (X1) with 9 assessment indicators, the owner capability variable (X2) with 5 assessment indicators, the contractor capability variable (X3) with 10 assessment indicators and the project external condition variable (X4) with 3 assessment indicators. Meanwhile, time performance (Y1), cost performance (Y2) and quality performance (Y3) have 2 assessment indicators.

Keywords: Construction project characteristics, Construction project performance,

1. INTRODUCTION

PT XYZ is railway transportation company. To support the rail transportation business, many construction projects have been carried out, especially in Jabodetabek such as, station revitalization, overcapping construction, construction of pedestrian, track, signaling, electricity etc. Construction projects are carried out with different characteristics starting from the tender process, type of contract, implementation method, technical specifications, environment, stakeholders etc. These differences in characteristics make different problems in each construction project implementation. While, the owner has the goal that the project has good performance based on time, cost and quality. Some contractors create projects with good project performance on time, cost and quality, but there are still contractors who produce poor project performance. Time performance data for the construction project of PT XYZ in the Jabodetabek area in 2018-2020 can be seen in the figure 1.

Based on Figure 1.1, it can be seen that the total of 15 projects implemented, only 1 project was finished earlier and 4 projects were finished on time, this means that 10 projects were time overrun. Time overrun will also indirectly affect to the cost and quality of the project. In general, project performance is influenced by the characteristics of the project. For example, Chan and Kumaraswamy (1999), found that project time and cost performance were influenced by project

characteristics, namely the procurement system, team performances, client representatives, contractors and environment. Molenaar and Songer (1998), analyzed the relationship between project characteristics : the nature of the project, owner, design and communication between stakeholders to the time and cost performance of the project. Kaming et al. (1997), identified the relationship between project characteristics : addendum requests, experience, and resources to project cost overruns using factor analysis.

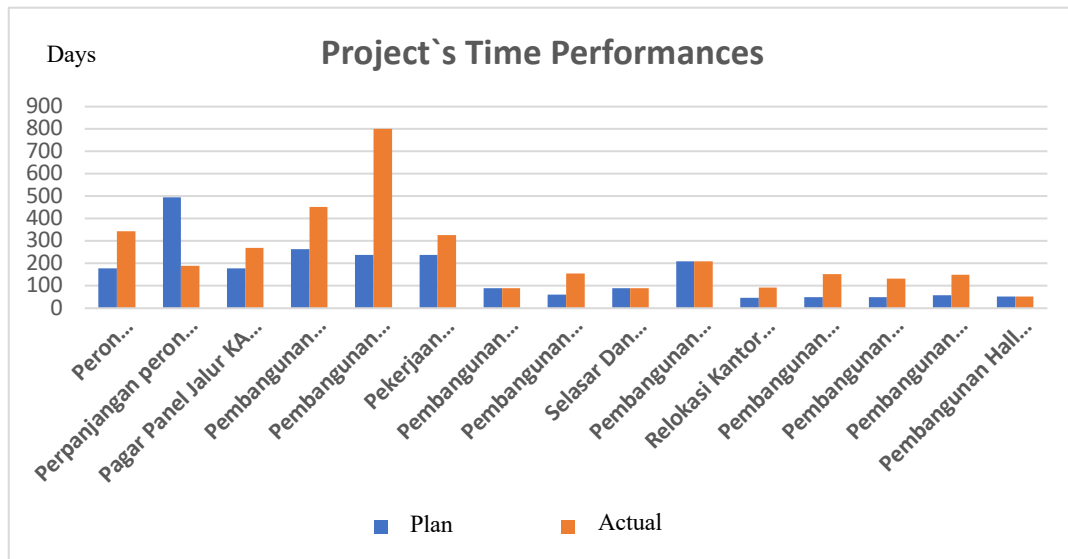


Figure 1. Time performance in 2018 – 2020

The implementation of PT XYZ construction project in the Jabodetabek is one of the main strategic investment activities. Part of the budget for investment activities comes from loan, therefore it is important to achieve PT XYZ's construction project performance as planned. Based on the problems that the performance of the resulting project is not as planned. The purpose of this study are to identify and modeling project characteristics project to performance based on time cost and quality using literature review and experts discussion.

2. LITERATURE REVIEW

Literature review in this study base on many previous studies. Many previous studies conducted an analysis of the factors that affect project performance. Several studies have also identified project characteristics. Previous research that is used as a reference in this study are as follows :

Chen et al. (2012) conducted a study of 62 critical success factors (CSFs) of construction projects. 62 (CSFs) refining to produce 46 (CSFs) by expert discussions. On the basis of the CSFs system, which consisted of three categories and ten subcategories, this study applied the structural equation model (SEM) to explore the interrelationships. Ten subcategories on this research are economic environment, owner's ability, political environment, natural environment, project characteristics, owner's preference, owner's expectation, project delivery characteristics, subcontractors characteristics and contractor's characteristics.

Ling (2004), is identify key factors that affect 11 areas of design-build (DB) project performance. Using data from 42 public and private DB projects, this study finds that contractor characteristics are the key determinants that affect the most number of performance metrics. The

most important variable is the contractor's track record for completing projects on budget, on schedule and to acceptable level of quality. Other important determinants are contractors' capability and adequacy of their resources.

Molenaar and Songer (1998), reports on the analysis of 122 case studies and the resulting automated tool for public sector design – build project selection. Models are developed for five performance criteria that correlate specific project characteristics to success. Performance criteria and associated models include budget variance, schedule variance, conformance to expectations, administrative burden, and overall user satisfaction. Project characteristics are categorized as project, owner, market and relationship variables.

Nyangwara and Evelyn (2015), This study analyzes the factors affecting the performance of construction projects to help owners, consultants and contractors to solve problems and improve project performance. Data were collected by questionnaire survey. 40 factors were identified and grouped into 8 groups, evaluated and ranked from the perspective of owners, consultants and contractors. The results show that the performance of construction projects is influenced by clients, contractors, consultants, stakeholders, regulators, the national economy, and others.

Construction Project Performance

construction project performance can be define as the result of work according the expectations and agreements of the stakeholders on contract. The concept of 'Iron Triangle', is a fundamental indicator for assessing and understanding construction project performance. The Iron Triangle is a representation of project success based on time, cost and quality. Thomas (2002) identified the performance of construction projects : financial stability, work progress, quality, safety, resources, client relations, consultant relationships, management capabilities, contract claims and disputes, relationships with subcontractors, reputation and number of subcontracts used. Cheung et al. (2004), identified project performance such as people, cost, time, quality, safety, environment, client satisfaction, and communication. Although many studies state that the 'Iron Triangle' time, cost and quality indicators cannot describe the overall performance of a construction project, until now these indicators are still the main aspect in assessing construction project performance against the plan (Pollack et al, 2018) .

a. Time Performance

Time performance is the process of comparing actual work with the schedule (Mattjik & Sumertajaya, 2011). The time performance of a construction project is measured based on the implementation time so that the project must be carried out in accordance with the specified time. Ensuring the project runs according to the specified time is very important because failure in time can cause additional project costs (cost overrun).

b. Cost Performance

In general, project cost is defined as the total cost required to complete the project. Project costs are determined based on quantitative calculations of project resource requirements such as labor, materials, logistics, etc. Performance of a construction project is good if the project cost is in accordance with the estimated budget cost. So the cost overrun can be estimated by dividing the change in the number of contracts by the number of initial contracts. Ling et al. (2004), said that the cost will increase with the acceleration of work, while increasing the duration will reduce costs.

c. Quality Performance

Success of the quality of a construction project is important to satisfaction of the project owner. The product or project results must meet the specifications and criteria required in the work agreement/ contract. Stojcetovic et al, (2014), the benefits of quality performance are customer

satisfaction, reduced product costs, increased productivity and better competitiveness. Quality failure is a very common and serious problem in construction projects because the expected quality is not met (Kaming & Olomolaiye, 1997). Failure to achieve the expected quality will have a significant impact on the cost and time of the project (Marosszeky et al, 2002)

Project Characteristics

Characteristics of construction projects are special inherit by each construction project. Turner and Muller (2002), stated that the project has three special characteristics: unique / no same project before and after, using a new process and temporary. There have been many studies that identify the characteristics of construction projects. Molenaar and Songer (1998), analyzed the relationship between project characteristics : nature of project, owner, design, and communication. Project performance : cost, time, etc. Corelation analisys use regression analysis and multivariate statistical analysis. Based on the previous literature study, the characteristics of the construction project in this study were determined below

a. Project Implementation System

Complexity of the project is always faced with many problems including cost, time, quality, social, stakeholder, type of project etc. Problem arises due to a lack of understanding of the project implementation system that can be developed to solve the problem. The project implementation system is a critical factor for project success : cost, and quality (Chen et al, 2012). The project implementation system is an activity that starts from the early stages of planning until the implementation of a construction project.

b. Owner capability

Owner is the person or entity that owns the project and provides work to the provider/ worker/ contractor. The owner has an important role in project implementation, based on project management knowledge the owner has control and responsibility for costs and revenues of project (Olsson & Johansen, 2016).

c. Contractor capability

Successful project performance is a fundamental issue for most government, private and organizational project implementations. A lot of literature discusses project performance which is influenced by several things, one of which is the capability of the contractor. Contractor capability factors that influence project success include: safety and quality, past performance, environmental management, technical management, resources, organization, experience with similar projects and financial condition. Chen et al, (2012) identified the criteria for contractor factors that determine project success, namely contractor experience, contractor's financial condition, reputation, capabilities, employees, technological and technical capabilities, working relationships, communication skills, availability of work materials and tools.

d. Project external condition

The implementation of a construction project is influenced by many factors, including internal and external conditions. Internal conditions come from the nature of the project while project external conditions are conditions outside the project that affect the implementation of a project. Many studies identify the external conditions of the project, Chen et al, (2012) identify the external factors of the project : economic conditions, political conditions and nature. Nyangwara and Evelyn, (2015) mention that the project environment includes economic, social, physical environments related to industry and technology. The process of running a construction project is influenced by the external environment, such as the environment, the influence of users, competitors, project location, climate, organization, social, culture, and anything that affects the success of the project (Wideman, 1990).

3. METHODS

This study use literature review on previous research and experts discussion method. Based on the literature review, We can found that project characteristics correlates with construction project performance based on time, cost and quality. This correlation is the basic research model. The objectives of the literature review are as follows:

- a. Identify variables and indicators on the characteristics of construction projects.
- b. Identify indicators on the construction project performance based on time, cost and quality
- c. Develop a conceptual model of project characteristics correlates with construction project performance based on time, cost and quality

The next step is the expert study. Expert studies is used to confirm that the variables and indicators from literature review are relevant. The expert study was conducted on five experts with a minimum education of a Bachelor's degree and a minimum 5 years of experience in the construction project of PT XYZ. The expert profile as shown in Table 1.

Table 1. Experts profile

Num.	Position	Education	Experience
1	Head of Division	Bachelor's degree of civil engineering	25 Years
		master's degree in business administration	
2	Project Manager	Bachelor's degree of civil engineering	15 Years
3	Project Manager	Bachelor's degree of architect	8 Years
4	Project Manager	Bachelor's degree of electrical engineering	10 Years
5	Project Manager	Bachelor's degree of civil engineering	20 Years
		Magister's degree of civil engineering	

4. RESULTS

Project Characteristics Variable

Based on the literature review on previous research and experts discussion, it were found that the project characteristics were formed by 4 variables namely project implementation system, owner capability, contractor capability and project external conditions. The project implementation system variable refers to the procurement process up to project implementation. The owner's capability variable relates to the technical/ non-technical capabilities and the owner's experience in implementing the project. The contractor capability variable is related to the technical/non-technical capabilities and experience of the contractor in implementing the project. Variables of project external conditions refer to weather conditions, environment, force majeure, economic conditions and political conditions. Each variable has its own indicators as shown in Table 2.

Table 2. Project characteristic variables and indicators

Variables	Indicators	Source
Project implementation system	Project delivery system	(Chen et al, 2012)
	Tender method	
	Completeness of design documents before tender	
	Number of contractors participating in the tender	
	Type of contract used	
	Project location	
	Design complexity	
	Complexity of construction work	
complete design		

Variables	Indicators	Source
Owner capability	Owner's ability to project complexity	(Ling, 2004)
	Owner's experience with similar projects	
	Availability of staff owned by the owner to oversee project implementation	
	Many projects have been done by the owner	
	Previous working relationship between owner and contractor	
Contractor capability	Contractor's experience with similar types of projects	(Chen et al, 2012)
	Contractor's financial condition	
	Contractor reputation	
	Project management skills of project manager	
	Ability of the staff/employees of the contractor	
	Contractor technology capability	
	Track Record of working relationship between contractor and owner	
	Contractor communication skills	
	The contractor's ability to provide work materials	
	Availability of work tools owned by contractors	
Project external condition	Weather conditions, environment and force majeure	(Chen et al, 2012)
	Political conditions (regulation, material taxes, war)	
	Economic conditions (inflation, rupiah exchange rate, fluctuations in material and labor prices)	

Construction Project Performance

Based on the literature review on previous research and experts discussion, it were found that project performance can be measured based on time performance, cost performance and quality performance variables with each indicator as shown in Table 3.

Table 3. Time, cost and quality performance variables and indicators

Variables	Indicators	Source
Time	Work according schedule / S curve made	(Cho et al, 2009)
	Time completion according to the initial contract	
Cost	Project costs according to budget plan	(Cho et al, 2009)
	Value of work according to initial contract	
Quality	Project quality based on specifications, design and contract documents	(Cho et al, 2009)
	No rework due to failure of work quality	

Conceptual Model

Conceptual models help understand the problem and ensure that the researcher builds a model that can represent the purpose of the research. This conceptual model built can later be used as the basis for making hypotheses to analyze the effect of project characteristics on the performance of time, cost and quality of the construction project of PT XYZ Jabodetabek Region. Based on the literature study and research objectives, a conceptual model was formed as shown in Figure 2. The conceptual model in Figure 2 is formed based on the concept that project characteristics affect the performance of time, cost and quality. Construction project performances based on time, cost and quality are endogenous latent variables that are influenced by exogenous latent variables, namely project characteristics. Meanwhile, the latent variable of project characteristics is influenced by the exogenous latent variable, namely project implementation system variable, owner capability variable, contractor capability variable and the project external condition variable.

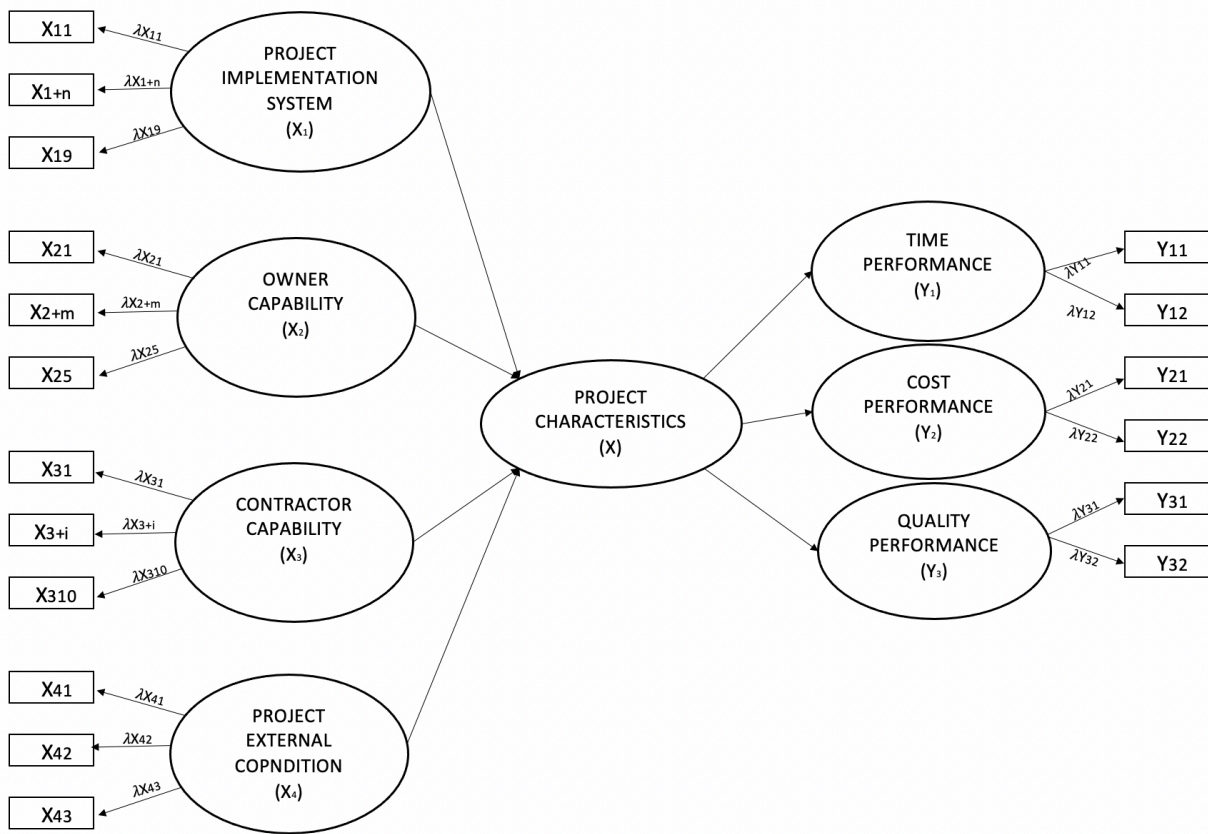


Figure 2. Conceptual Model

6. CONCLUSIONS

Based on the literature study on previous research and expert study, it was found that the project characteristic variables were formed by four variables with indicators, namely implementation system (X₁) with 9 assessment indicators, the owner capability variable (X₂) with 5 assessment indicators, the contractor capability variable (X₃) with 10 assessment indicators and the project external condition variable (X₄) with 3 assessment indicators. Meanwhile, time performance (Y₁), cost performance (Y₂) and quality performance (Y₃) have 2 assessment indicators.

7. SUGGESTION AND FURTHERMORE

This conceptual model is the result of initial research. Researchers can use this conceptual model include variables and indicators to analyze the effect of project characteristics on the performance based on time, cost and quality of construction projects.

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