International Journal of Engineering & Technology, 9 (2) (2020) 546-551

International Journal of Engineering & Technology

Website: www.sciencepubco.com/index.php/IJET

Research paper

Risk analysis of construction planning that affecting quality and time control in the apartment development performance using PLS - SEM method (case study in apartments in Tangerang)

Angga Sumantri [1] *, Nunungwidyaningsih [2], Bambang P. K. Bintoro [2]

[1] Students of the Civil Engineering Master's Program at Mercu Buana University
[2] Lecturer in Civil Engineering, Mercubuana University.
**Corresponding author E-mail: angga.cometindo@gmail.com*

Abstract

Large-scale projects, especially construction projects, have a large degree of difficulty in planning and controlling. For the project to work, a rigorous project planning and control analysis is required. This study aims to identifythe relationship between construction planning risk, quality control, time control, and management performance. Three apartment development projects in the Tangerang area were researched and 58 respondents were selected as the research sample. Based on the results of PLS SEM analysis, it was found that the risk of construction planning has a positive and significant effect on quality control and also on time control. Project control in terms of quality and time has a positive influence on management performance in apartment construction. If the company can carry out quality control and time correctly, then management performance will increase, but the performance improvement is not significant.

Keywords: *Apartment; Risk; Quality Control; Time Control; Management Performance.*

1. Introduction

Each development project has risk factors that originate from the project's internal or external project that can affect the achievement of project performance and the objectives of the project. There are times when an event can affect an entire project, but at other times there are events that will only affect a portion of the project.
Therefore, it is necessary to carry out a project risk analysis to ensure that a project can run according to established goals and plans. A project requires supervision so that it can run smoothly and get good quality accompanied by the use of costs in an efficient and effective time.
This research focuses on apartment construction projects, especially in the Tangerang area. Riyandi (2019) reports that for 2019 to 2022 there are estimated to be 32,600 new supplies, and as many as 57% are in Tangerang. Development is a large-scale project. However, construction of apartments often experiences delays. For example, in the K2 Park apartment development project in Serpong Banten that promised key handover in December 2018, but as of September 2018, the construction project had not yet begun. This delay results in a large amount of costs that must be borne by the developer. Based on data from YLKI also found an increase in consumer complaints about property development services, especially apartments. Rosana (2019) reports that during 2018, YLKI received 98 complaints from the public regarding customer dissatisfaction with housing and apartment management. This shows that the measurement of management performance in the construction of apartments is important for the completion of the apartment with the appropriate quality and time.

2.1. Construction planning risks

According to Anderson (2009), risk planning is the first step of risk management activities. Careful and explicit planning will be able to increase the success of other processes in risk management. Risk planning is very important to ensure that the level, type and visibility of risk management are as important as the project organization. This is done in order to provide the resources and time needed for risk management activities, and to establish a basis for approval to evaluate risks. Risk planning must be completed at the beginning of the construction project planning stage. The risk planning stage will produce a risk plan document that explains how risk management is organized and implemented in construction projects. The risk plan is a subset of the overall construction project plan.
Besner and Hobbs (2012) state that risk management in projects includes matters related to practices and tools used in managing project risks. However, the practices and tools used in managing project risk vary from author to writer. Crispim et al. (2018) find that the selection

depends very much on the risk management phase and the context of the project. This is also in line with what was said by Edwards and Bowen (1998).

Project risk management must be carried out seriously by all parties, so that the project can be carried out effectively and efficiently. Specifically, Tanmay et al. (2017) examines and proves the important role of project managers in planning appropriate risk mitigation strategies, especially for construction projects. The results of this study are also supported by the findings of Ephrem et al. (2016) who conducted research in Africa, representing a sample of developing countries. In this research, it was found that the competence of the project manager will determine the success of the construction project. The same finding was also obtained by Hong et al. (2016) who conducted research on construction projects in Vietnam.

The most common risk in the implementation of construction is the delay (delay) in the construction of construction projects. Liu (2009) states that projects that experience delays and overbudget have a direct impact on the bottom-line of a business. Based on the research results of Aziz MD et al. (2016), it was found that the main factors that caused the delay were: resource, environmental , and coordination groups . The risk of this delay will affect project performance and also management performance, therefore an introduction to the effect of potential risks on project performance is needed.

Risk management in construction projects is one of the most important processes in achieving project objectives in terms of cost, time, and quality (Ali and Oduoza, 2017).

2.2. Project control

Project controls can generally be grouped into quality, time and cost controls. The project control factors that can affect time performance and quality on the project can be divided into (Zailani, et.al , 2016):

1) Material factors (materials) consist of:
a) Shortage of materials at the construction site (shortage of materials on site)
b) Material changes in form, function and specifications
c) Material delivery delays
d) Material damage in storage
e) Scarcity of material
f) Inaccuracy in ordering materials
2) Factors equipment (equipment), consisting of:
a) Equipment damage
b) Lack of equipment and tools on site (equipment and tool shortage on site)
c) Equipment productivity
3) Financial factors (financing), consisting of:
a) Financial availability during implementation (financial problems)
b) Late payment process by owner
c) There is no incentive money for the contractor if the completion time is ahead of schedule.
4) Environmental and community factors (environment), consisting of:
a) Effect of weather on construction activities
b) The effect of environmental security on project development
c) Geological problems at the location
d) Lack of communication between the contractor and the community
5) Labor factor (man power), consisting of:
a) Shortage of labor (shortage of site labor)
b) Ability of labor (poor skilled and experience labor)
c) Contractor competence
d) Subcontractors or work partners are not experts in their fields
e) Understanding the job specifications are not the same
f) Interference or owner intervention.
6) Planning factors, consisting of:
a) Late licensing before implementation
b) Design changes occur
c) Design error by planner
d) The occurrence of additional work
7) Management factors, consisting of:
a) Weak time control system
b) Poor arrangement of activities
c) No job specification evaluation was carried out prior to implementation
d) The absence of operating procedures for each job
e) Error in understanding contract documents
f) Poor K3 management
g) Inappropriate quality management procedures.

2.3. Project management performance

The project is a series of interrelated activities and events to achieve certain goals and produce results within a certain period by utilizing available resources. Project Management Performance is a measure of the work of management in working on a project, which includes systems, procedures, and general management and specifically in handling projects.

2. Research method

Research classified as survey research by using questionnaires as the data source. While this type of research is quantitative research in the form of Partial Lest Square (PLS) - structural equation modeling (SEM) .

3. Results and discussion

In this study, 58 respondents' data were collected which will be further analyzed using PLS - SEM analysis. Analyzes were performed using SmartPLS software. The output of the standardized solution and the loading factor value of each indicator is shown in Figure 1.

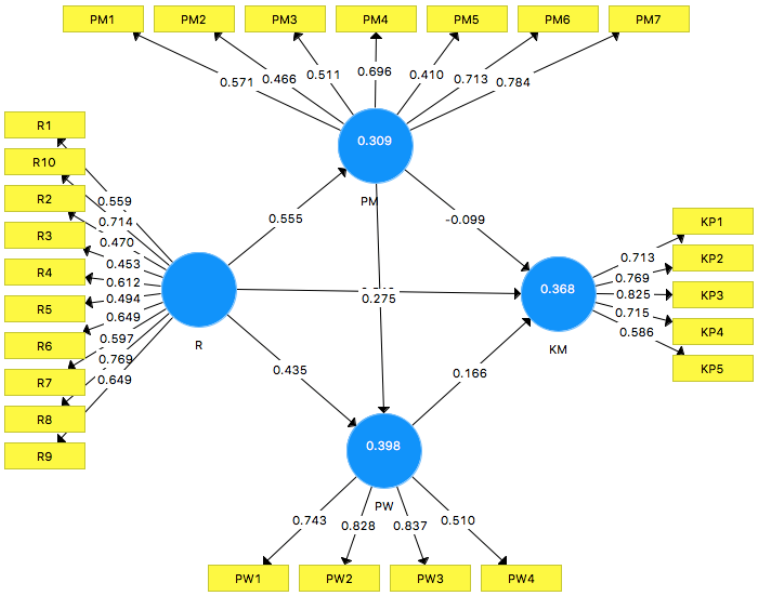

Fig. 1: Standardized Solution Output – Initial.

Table 1: Value of Loading Factor - Initial

Indicator	Risk	Quality Control	Time Control	Management Performance
R1	0,559			
R2	0,470			
R3	0,453			
R4	0,612			
R5	0,494			
R6	0,649			
R7	0,597			
R8	0,769			
R9	0,649			
R10	0,714			
PM1		0,571		
PM2		0,466		
PM3		0,511		
PM4		0,696		
PM5		0,410		
PM6		0,713		
PM7		0,784		
PW1			0,743	
PW2			0,828	
PW3			0,837	
PW4			0,510	
KP1				0,713
KP2				0,769
KP3				0,825
KP4				0,715
KP5				0,586

Based on figure 4.4 and table 4.13 above, it can be seen that there are still many indicators that have a loading factor value <0.6. Therefore, modeling will be done by removing all indicators that have a loading factor value <0.6. After several iterations, the output of the standardized solution and the loading factor value of each indicator are shown in Figure 2.

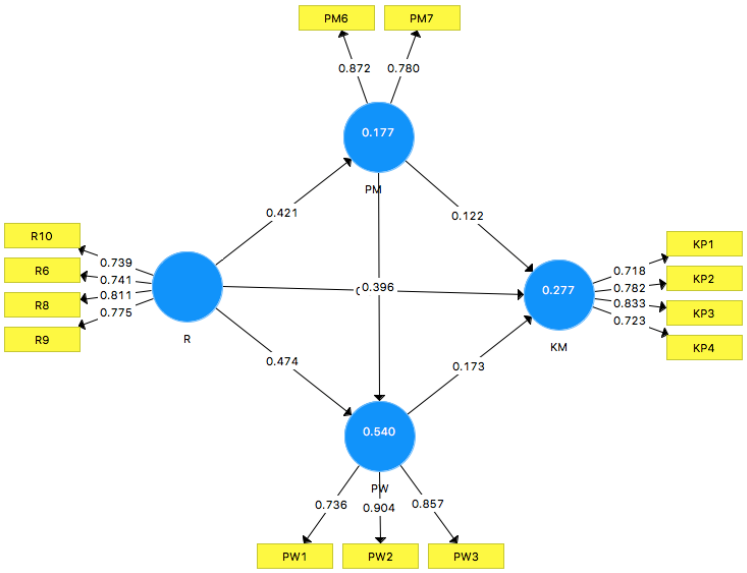

Fig. 2: Output Standardized Solution – Final.

Table 2: Value of Loading Factor - Initial

Indicator	Risk	Quality Control	Time Control	Management Performance
R6	0,741			
R8	0,811			
R9	0,775			
R10	0,739			
PM6		0,872		
PM7		0,780		
PW1			0,736	
PW2			0,904	
PW3			0,857	
KP1				0,718
KP2				0,782
KP3				0,833
KP4				0,723

The results in figure 4.5 and table 4.14 show that all loading factor values of the indicator have good values (> 0.7).
This study examines the relationship between risk variables, Quality Control, Time Control, and Management Performance. Based on the research model developed from the literature review, it can be tested on the research hypothesis which can be seen in table 1.

Table 1: Research Hypothesis Test

Relationship	Direct Influence	P Values	Information
Risk -> Quality Control	0,421	0,000	Positive and significant
Risk -> Time Control	0,474	0,000	Positive and significant
Quality Control -> Time Control	0,396	0,045	Positive and significant
Quality Control -> Management Performance	0,122	0,554	Positive and not Significant
Time Control -> Management Performance	0,173	0,464	Positive and not Significant
Risk -> Management Performance	0,321	0,150	Positive and not Significant

Based on the table above can be seen the effect between the dependent variable and the independent variable, which is explained as follows:

- Risk variable has a positive and significant effect on Quality Control Variables. The positive effect of the Risk variable on Quality Control can be seen from the magnitude of the effect of 0.421. The significance of the effect of the Risk variable on Quality Control can be seen from the p-value of 0,000 (<0.05) , which means that the Risk variable significantly influences the Quality Control variable.
- Risk variable has a positive and significant effect on Time Control Variables. The positive influence of the risk variable on Time Control can be seen from the magnitude of the effect of 0.474. The significance of the effect of the Risk variable on Time Control can be seen from the p-value of 0,000 (<0.05) , which means that the Risk variable significantly influences the Time Control variable.
- Quality Control Variables have a positive and significant effect on Time Control Variables. The positive effect of the Quality Control variable on Time Control can be seen from the magnitude of the effect of 0.396. The significance of the influence of the Quality Control variable on Time Control can be seen from the p-value of 0.045 (<0.05) , which means that the Quality Control variable significantly influences the Time Control variable.
- Quality Control Variables have a positive and significant effect on Management Performance Variables. The positive influence of the variable Quality Control on Management Performance can be seen from the amount of influence of 0.122. The significance of the influence of the Quality Control variable on Management Performance can be seen from the p-value of 0.554 (> 0.05) , which means that the Quality Control variable does not significantly influence the Management Performance variable.
- Time Control Variables have a positive and significant effect on Management Performance Variables. The positive influence of Time Control variables on Management Performance can be seen from the amount of influence of 0.173. The significance of the influence of the Time Control variable on Management Performance can be seen from the p-value of 0.464 (> 0.05) , which means that the Time Control variable does not significantly influence the Management Performance variable.

- Risk variable has a positive and significant effect on Management Performance Variables . The positive effect of the Risk variable on Quality Control can be seen from the magnitude of the effect of 0, 3 21. The significance of the influence of the Risk variable on Quality Control can be seen from the p-value of 0, 15 0 (> 0.05) , which means that the variable Risk does not significantly influence Management Performance variables.

Risk Influence Model on Quality Control :
Effect of Risk Variables on Quality Control, based on the results of the PLS-SEM analysis, is shown in the following equation:

0.421 R isk = P engendalian M utu

Based on the above equation model, it can be concluded that if there is an increase in Risk Variable of 1, the Quality Control Variable will increase by 0.421. Risk planning is important for the construction of apartment projects because it determines the quality of the project. If risks have been identified from the project planning stage, then mitigation strategies that guarantee project quality can also be well thought out.
The coefficient of determination of the model of the influence of Risk Variables on Quality Control, based on the results of the PLS-SEM analysis, is as follows:

R^2 = 17.7%

This means that the Risk variable can explain the variance that occurs in the Quality Control variable by 17.7%. While the remaining 82.3% is explained by other variables. The calculation of Goodness of Fit in the model of the influence of Risk Variables on Quality Control is:

$GoF = \sqrt{AVE * R^2} = \sqrt{0{,}684 * 0{,}177} = 0{,}3479$

A GoF value of 0.3479 is included in the medium category (Akter et al., 2011), so it can be concluded that the model of the influence of Risk Variables on Quality Control is quite consistent and valid.

The Model of Influence of Risk and Quality Control on Time Control
Effect of Risk Variables and Quality Control on Time Control, based on the results of the PLS-SEM analysis, is shown in the following equation:

0.474R + 0.396PM = PW

Based on the above equation model, it can be concluded that if the Risk Variable increases by 1 and the Quality Control variable is constant, the Time Control Variable will increase by 0.474. If the Quality Control Variable increases by 1 and the Risk variable is constant, the Time Control Variable will increase by 0.396. Risk planning and quality control are important for the construction of an apartment project because it determines the controlled time of the project completion. If risks have been identified since the project planning and quality control stages have been carried out consistently, the project can proceed according to the planned time. The timely completion of apartment projects will certainly lead to the satisfaction of apartment buyers and also all stakeholders .
The coefficient of determination of the model of the influence of Risk Variables and Quality Control on Time Control, based on the results of the PLS-SEM analysis, is as follows:

R^2 = 54%

This means that the Risk and Quality Control variables, simultaneously, can explain the variance that occurs in the Time Control variable by 54%. While the remaining 56% is explained by other variables. The calculation of Goodness of Fit on the model of the influence of Risk Variables and Quality Control on Time Control is:

$GoF = \sqrt{AVE * R^2} = \sqrt{0{,}698 * 0{,}54} = 0{,}6139$

A GoF value of 0.6139 is included in the large category (Akter et al., 2011), so it can be concluded that the model of the influence of Risk Variables and Quality Control on Time Control is consistent and valid.
The Model of Influence of Risk, Quality Control, and Time Control on Project Management Performance
Effect of Risk Variables, Quality Control, and Time Control on Project Management Performance, based on the results of the PLS-SEM analysis, is shown in the following equation:

0,396R + 0,122PM + 0,173PW = KP

Based on the above equation model, it can be concluded that if there is an increase in Risk Variable of 1 and the variable Quality Control and Time Control constant, then the Management Performance Variable will increase by 0.396. If there is an increase in the Quality Control Variable by 1 and the Risk and Time Control variable is constant, then the Management Performance Variable will increase by 0.122. If an increase in Time Control Variable is 1 and the Risk and Quality Control variable is constant, then the Management Performance Variable will increase by 0.173. Risk planning, quality control and time control will determine management performance in the construction of apartment projects. If risks have been identified from the project planning stage, quality control and time control are carried out consistently, then management performance can be said to be successful. Apartment projects will be completed on time with guaranteed quality.
The coefficient of determination of the influence model of Risk Variables, Quality Control and Time Control on Management Performance, based on the results of the PLS-SEM analysis, is as follows:

R^2 = 27.7%

This means that the variables Risk, Quality Control, and Time Control, can simultaneously explain the variance that occurs in the variable Management Performance by 27.7%. While the remaining 72.3% is explained by other variables. Calculation of Goodness of Fit on the influence model of Risk Variables, Quality Control, and Time Control on Management Performance are:

$$GoF = \sqrt{AVE * R^2} = \sqrt{0{,}586 * 0{,}277} = 0{,}4028$$

GoF value of 0.4028 is included in the large category (Akter et al., 2011), so it can be concluded that the model of the influence of Risk Variables, Quality Control, and Time Control on Management Performance is consistent and valid.

4. Conclusion

Based on the analysis results, the following conclusions are obtained:

1) The risk of construction planning has a positive and significant effect on quality control and also on time control. If from the beginning of the project planning, the company has been able to identify risks and minimize the occurrence of risks, then when the project is running it will be easier to control the quality of the project and its completion time.
2) Project control in terms of quality and time has a positive but not significant effect on management performance on apartment construction. If the company can carry out quality control and time correctly, then management performance will increase, but the performance improvement is not significant. The positive influence of quality and time control in the project on management performance provides information so that management still takes project control seriously.

Project control in terms of quality has a positive and significant effect on project control in terms of time. If the company continues to improve its quality achievements, the completion time will be easier to control. This of course will have an impact on the timely completion of the apartment. Although it does not significantly influence management performance, a project that has good quality and is completed on time will certainly affect customer satisfaction, which in turn will enhance the reputation of the company.

Acknowledgments

The authors thank the Head of the Study Program Dr.Ir. Budi Susetyo, MT. Likewise, the authors express my gratitude to all lecturers and administrative staff of the Master Program in Civil Engineering, including fellow students who have sympathy and assistance so that the author can complete this Thesis. Finally, the authors thank the parents, who with great affection and patience encouraged the writer to complete this scientific work.

References

[1] R. V. Dandage, S. S. Mantha, and S. B. Rane, “Strategy development using TOWS matrix for international project risk management based on prioritization of risk categories,” *International Journal of Managing Projects in Business*, vol. 12, no. 4, pp. 1003-1029, 2019. https://doi.org/10.1108/IJMPB-07-2018-0128.

[2] J. Crispim, L. H. Silva, and N. Rego, “Project risk management practices: the organizational maturity influence,” *International Journal of Managing Projects in Business*, vol. 12, no. 1, pp. 187-210, 2019. https://doi.org/10.1108/IJMPB-10-2017-0122.

[3] H. A. Vu, V. H. Cu, L. X. Min, and J. Q. Wang, “Risk analysis of schedule delays in international highway projects in Vietnam using a structural equation model,” *Engineering, Construction and Architectural Management*, vol. 24, no. 6, pp. 1018-1039, 2017. https://doi.org/10.1108/ECAM-06-2016-0138.

[4] S. Zailani, H. A. Md. Ariffin, M. Iranmanesh, S. Moeinzahed, and M. Iranmanesh, "The moderating effect of project risk mitigation strategies on the relationship between delay factors and construction project performance", *Journal of Science and Technology Policy Management*, vol. 7, no.3, pp. 346-368, 2016. https://doi.org/10.1108/JSTPM-12-2015-0041.

[5] A. Rostami and C. F. Oduoz, “Key risks in construction projects in Italy: contractors' perspective,” *Engineering, Construction and Architectural Management*, vol. 24, no. 3, pp. 451-462, 2017. https://doi.org/10.1108/ECAM-09-2015-0142.

[6] L. Liu., “How does strategic uncertainty and project sponsorship relate to project performance? A study of Australian project managers,” *Management Research News*, vol. 32, no. 3, pp. 239-253, 2009. https://doi.org/10.1108/01409170910943101.

[7] P.J. Edwards and P.A. Bowen, “Risk and risk management in construction: a review and future directions for research Engineering,” *Construction and Architectural Management*, vol. 5, no. 4, pp. 339 – 349, 1998. https://doi.org/10.1046/j.1365-232X.1998.54072.x.

[8] C. Besner and B. Hobbs, “The paradox of risk management; a project management practice perspective,” *International Journal of Managing Projects in Business*, vol. 5, no. 2, pp. 230 – 247, 2012. https://doi.org/10.1108/17538371211214923.

[9] E. Sinesilassie, S. Tabish, and K. Jha, “Critical factors affecting schedule performance: a case of Ethiopian public construction projects – engineers’ perspective,” *Engineering, Construction and Architectural Management*, vol. 24, no. 5, pp. 757-773, 2017. https://doi.org/10.1108/ECAM-03-2016-0062.

[10] P. Kumar and V. K. Baradiya, "Construction Risk Assessment through Partial Least Square Technique," *Proceedings of Recent Advances in Interdisciplinary Trends in Engineering & Applications (RAITEA) 2019*. https://doi.org/10.2139/ssrn.3353125.

[11] A. Memon and I. Rahman, “Analysis of cost overrun factors for small scale construction projects in Malaysia using PLS-SEM method” *Modern applied science*, vol. 7, no. 8, 2013. https://doi.org/10.5539/mas.v7n8p78.

[12] N.S. Asmarantaka, “Analisis Risiko Yang Berpengaruh Terhadap Kinerja Proyek Pada Pembangunan Hotel Batiqa Palembang,” *Journal of Civil and Environmental Engineering*, vol. 2, no. 3, 2014.

[13] Iribaram, F. Wati, and M. Huda, "Analisa Resiko Biaya Dan Waktu Konstruksi Pada Proyek Pembangunan Apartemen Biz Square Rungkut Surabaya," *axial: jurnal rekayasa dan manajemen konstruksi*, vol. 6, no. 3, pp. 141-154, 2019.

[14] M. R. A. Simanjuntak and B. Garundita, "Identifikasi Risiko Tahap Perencanaan Proyek Dalam Meningkatkan Kinerja Pembiayaan Proyek Apartemen X Semarang," *Konferensi Nasional Teknik Sipil 12*, Batam, 2018.

[15] M. Sobirin, “Kinerja Proyek Konstruksi Bangunan Gedung Di Pengaruhi Oleh Beberapa Faktor Seperti Sumber Daya Manusia, Sumber Daya Alat Dan Sumber Daya Material,” *Jurnal Sains dan Teknologi Teknik Utama*, vol.11, no. 2, pp. 117-132, 2016.