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Recommendation Results of Construction Process Risk Analysis (Case Study of Construction Projects: Apartments in Tangerang)

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ABSTRACT: The problems to be solved in this study are identifying risks in the construction process, analyzing the risks of the project construction phase, managing risks in the construction process, reviewing project operational performance indicators and providing recommendations from the results of this study. The result of risk identification obtained 75 free risk variables (X) and one dependent variable (Y) and the results of risk analysis obtained 6 risk variables that influence the operational performance of apartment construction projects by formulating the equation $Y = 0.115 X_{38} + 0.108 X_{20} + 0.148 X_{29} + 0.189 X_{54} + 0.214 X_{35} + 0.172 X_{48} + 0.38$. The explanation of the above equation is, Y as the operational performance of apartment buildings in Tangerang, variable X38 labor-related problems (availability of expert labor, production power, supervisory staff) which have an influence of 48.5%, variable X20 construction method (wrong or improper work implementation) which has an influence of 17.1%, variable X29 number of equipment that is insufficient which has an effect of 10.2%, variable X54 occurrence of work accident which has an effect of 4.20%, variable X35 the insufficient number of experienced personnel which have an influence of 4.2%, and the variable X54 inadequate financial availability by the owner who has an influence of 3.8%. Risk response strategies to prevent risk are carried out by avoiding risks and reducing / mitigating risks. The results of this analysis recommend managing risk by considering the magnitude and level of importance of the impact that will affect the operational performance of the apartment project.

KEYWORDS: analysis, risk, contruction process, operational performance, apartment project

I. INTRODUCTION

Growth and development of urban areas will be going on continuously. This is due to the increasing number of population and the process of urbanization of urban areas which of course will greatly affect the supply of cultivation areas both settlements and non-settlements. Development in Tangerang is growing rapidly including property development. This is indicated by various developments ranging from apartments, hotels, shopping centers, offices, warehouses and industrial areas. According to research by Cushman and Wakefield Indonesia in the megapolitan areas of Jakarta, Bogor, Depok, Tangerang and Bekasi (Jabodetabek). Tangerang is the region with the most apartments in the Jabodetabek, which is 30.9 percent in the fourth quarter of 2016, after Tangerang, the second most apartment is in east Jakarta, namely Bekasi as much as 19.5 percent. The other regions with the most apartment respectively are West Jakarta 9.8%, South Jakarta 8.8%, Bogor 8.6%, and Depok 7.6%. Based on Kompas.com records until February 2017, Tangerang dominates number of apartments by 44.4% from a total of 8,571 units, followed by Bekasi 21.1% and

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Central Jakarta 12.4%. [1]. Construction activities which are one of the investment activities always expect to be successful, but investment activities will always have a risk. The successful implementation of a project conducted by a construction service company is related to the extent to which the three objectives can be met. The successful implementation of apartment construction is linked to the project's objectives, which has an impact on the operational performance of the apartment project development in Tangerang. Projection of apartment availability in 2016-2018 from 77,549 units to 75,083 units, this decline occurred due to several things such as a slow development process, a late schedule, or a problem of development permits [2]. Similarly, Perumnas did not achieve the apartment development target in 2016 which planned 10,089 units but only realized 9,742 units [3].

The problems to be solved in this study are identifying risks in the construction process, analyzing the risks of the project construction phase, managing risks in the construction process, reviewing project operational performance indicators and providing recommendations from the results of this study. The research objectives are 1. identifying the risk of the construction process of apartment project in Tangerang, 2. analyzing the risk of the construction process of an apartment project in Tangerang that affects the operational performance, 3. managing the construction process risk that affects operational performance, 4. reviewing project operational performance indicators 5. provide recommendations for improving the risk analysis research model of the construction process.

II. LITERATURE STUDY

Risk management

In the context of the project, risk is an uncertain condition or event which if it occurs has a positive or negative effect on the project target. A risk has a cause and if the risk occurs, there will be consequences. If what occurs is undesirable events, the impact is on cost, schedule, and quality of the project. Project risk is a potential event that negatively affects the achievement of project goals and objectives [4]. Uncertain, in the future, but it can negatively affect the project objectives, which are costs, quality and time. While project risk management is a systematic and logical method for identifying, analyzing, planning responses, controlling risks and monitoring risk control activities in each activity and process in the project implementation [4]. The project risk management process consists of 1. Risk identification, 2. Risk assessment and measurement, 3. Determination of response to risk, 4. Risk control and risk monitoring [4].

Risk is a future event that may or may not occur but if that happens it will have an impact on the project scope, schedule, budget and quality. The risk may have one or more causes and if that happens, it has one or more impacts [5]. Risk is the possibility of something happening that will have an impact on the goal (AS / NZS 4360: 2004). Project risk is an uncertain event or condition which, if it occurs, has a positive or negative effect on one or more project objectives such as scope, schedule, cost, and quality [6]. Project risk management includes the process of carrying out risk management planning, identification, analysis, response planning, and risk control on a project. The purpose of project risk management is to increase the likelihood and impact of positive events, reduce the likelihood and impact of negative events in the project [6]. Risk analysis can be done in qualitative and quantitative ways. In this study risk analysis will be carried out using quantitative methods.

Project performance

Performance is the result of work that has a strong relationship with the organization's strategic goals, customer satisfaction, and contributes to the economy. The performance control process generally consists of three main steps, as follows: a. Set performance standards. This standard can be budgeted costs and schedules. b. Measuring performance against standards by comparing actual performance and performance standards. The results of work and expenses that have occurred compared to the planned schedule and costs. c. Take corrective action if there is a deviation from the standard set [8]. The performance of a building can be measured from the indicators of cost, quality, and time performance by carefully planning, thorough, and integrated all the allocation of resources (human, material and machine) that must align with the goals and objectives of the organization.

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Project performance is limited by three constraints (triple constraints), which are the cost/budget constraints, schedule and quality [9]. Project management is successful if the project has achieved the desired project objectives, has reached the allocated time period, budgeted costs, at the desired level of performance / technology, is accepted by the customer and uses the resources determined effectively and efficiently [10].

Project performance is how the project works by comparing the actual work results with estimated work of the work contract agreed upon by the owner and the implementing contractor. Reporting on the performance results of a project must meet five components, as follows: 1. Forecast, which will provide a standard for comparing actual results with forecast results. 2. The actual happened. 3. Prediction, which is based on seeing what will happen in the future. 4. Variant, states to what extent the actual results occur are different from what is estimated / predicted. 5. Thought, to explain about the state of the project. If in a report there is a deviation, management will examine and understand the reasons behind it. For this reason, control is needed so that the work is in accordance with the budget, schedule and specifications that have been set.

Operational management

The operational activities of a project are based on the concept of utilizing existing systems continuously and repeatedly [9]. Thus, a building is built first through a construction project, then operated as a routine activity and takes place in the long term (operational phase). The main activity in the operational phase of a building is the maintenance and repairment of a building. Management of building maintenance aims to study, identify, measure, and analyze and repair operational function damage of the building by increasing its lifetime, reducing the probability of damage, and reducing downtime which will ultimately increase the availability of the building to operate.

III. RESEARCH METHODE

In order for research to be more focused, it is necessary to make steps in the research research operational model so that the purpose of this research is achieved, Complete research operational model can be seen in Figure 1.

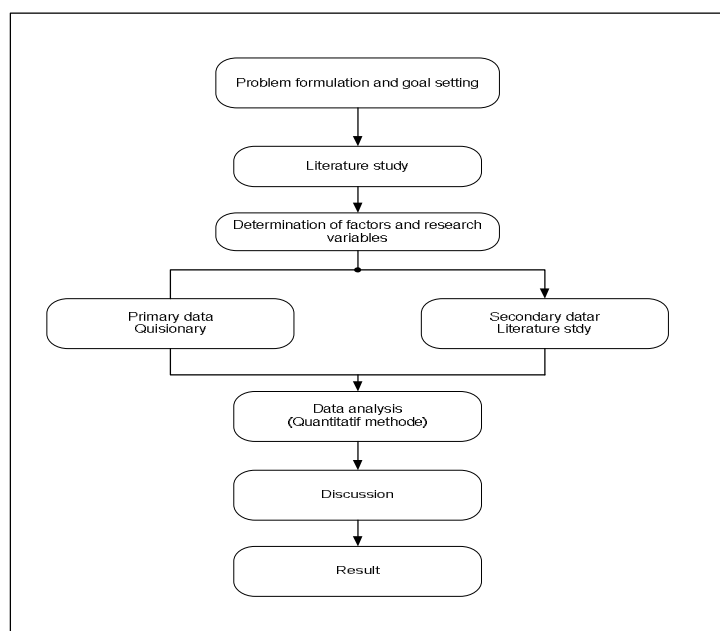


Fig 1. Research operational model

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The research process begins with the formulation of problems which from the results of previous studies and those encountered in the practical that will be solved and continued with the determination of the objectives of the research so that research is more focused. The next step is to conduct a literature review and selected books and journals that will be used as references in this study. The review is carried out in terms of the theory and results of previous studies that are still related to this research. From this step, the risk variables are determined which as the basis of the questionnaire design to collect primary data through surveys. Data that has been collected is then processed and analyzed with quantitative methods, the results of which are discussed and conclusions will be drawn and suggestions are given based on the findings of this study.

IV. ANALYSIS AND DISCUSSION

Data collection in this study was carried out through two stages, namely secondary data collection carried out by literature review of books and relevant research results to obtain information related to risk variables in the construction process. The second data collection was carried out by the first phase of the survey, which was a survey of experts to validate the risk variables that had been obtained.

1.1. Risk identification

The construction phase is the implementation phase of a project that has been planned, at this stage many resources will be used such as material, machinery, money, methods, labor, at this stage a project can be realized after going through the planning stage. In the life cycle of the construction phase, the implementation phase is the most complex stage that the problem will arise, ranging from technical, financial, claims to social problems, so that at this stage the control process must be carried out in the implementation activities and control of irregularities that occur. Risk identification is identifying conditions of uncertainty that have an impact, the source of risk and its effects. The approach used in identifying risks in this study is the literature study of previous studies. The risk of the construction phase has been identified based on the Work Breakdown Structure of the construction process. The construction process includes activities including 1. preparing land for the project location, 2. building a board of directors or temporary project offices in the field, 3. civil works 4. erection and installation [4]. Building construction has specific characteristics, especially in implementation technology. The implementation method for building consists of 1. Preparation, 2. Dewatering, 3. Bottom structure, 4. Upper structure and 5. Finishing [11]. From the results of the literature review, the risk variables that influence the construction process of the apartment are obtained. From the results of the literature review is obtained risk variables that affect the construction process of the apartment. The results of risk identification that are the risk variables that may occur in the construction phase of the apartment construction project in Tangerang. There are 8 risk factors with 75 independent risk variables (X) and one dependent variable (Y), which is the operational performance of the apartment project. Those risk factors are material, equipment, human resources, contractor qualifications and experience, financial, management, natural / environmental conditions. [10],[12],[13],[14],[15],[16],[17],[18],[19],[20]. The above risk variables are identified from the phases of the construction process which are divided into 4 phases: planning phases, preparation phases, implementation phases, evaluation phases and documentation phases. The purpose of this initial test is to test the content validity. Content validity shows the level of the items in the questionnaire representing the concept to be measured [21]. This initial test was carried out by asking the opinions of experts in the construction field consisting of practitioners and academics. Expert test is carried out by construction experts as many as three persons with S3, S2 and S1 education with work experience of 18 to 30 years. Questionnaires are submitted to experts to validate the risk variables that have been identified. Questionnaires distributed to experts consist of 75 independent risk variables (X) and one dependent variable (Y). The results of the validation by the experts were 2 experts stated that 75 independent variables (X) and the dependent variable (Y) were considered valid by experts to be used as a subsequent survey to respondents and one expert stated 74 independent variables (X) and one dependent variable (Y) were stated valid for use as survey questions to respondents. Based on the results of the expert test, because most experts stated that 75 independent variables (X) and one dependent variable (Y) were valid, the survey of respondents would use 75 independent variables (X) and one dependent variable (Y).

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1.2. Construction process risk analysis

The next step is to analyze data from survey questionnaires involving 35 respondents from contractors. The first analysis using SPSS 22 by conducting a non-parametric analysis to find out whether there were differences in perceptions among respondents with the differences in education, work experience and position in the project. The results of nonparametric analysis using the Mann Whitney U Test for the education category and Kruskal Wallis for work experience, the results of which showed no differences in perceptions among respondents who had differences in education, experience and position.

Furthermore, quantitative analysis is carried out using the SPSS 22 program, beginning with the validity test and reliability test on the data to determine the reliability and validity of the data as a measurement tool in this study. The results of this analysis show that 75 risk variables have validity that meets the requirements with r count (pearson correlation) $0.325 > r$ table which means all variables are valid. While the reliability test obtained the value of crombach $\alpha = 0.919$ means that the measurement instrument used in this study is reliable because $r = 0.919 > 0.7$, it can be concluded that all valid variables with very high reliability. The next step is factor analysis and regression analysis and the six risk variables that influence the operational performance of apartment projects are obtained by following the regression equation as follows: $Y = 0.115 X_{38} + 0.108 X_{20} + 0.148 X_{29} + 0.189 X_{54} + 0.214 X_{35} + 0.172 X_{48} + 0.38$. Y as operational performance in apartment buildings in Tangerang, variable X_{38} labor-related problems (availability of expert labor, production power, supervisory staff) which have an influence of 48.5%, variabel X_{20} construction method (wrong or improper work implementation) which has an influence of 17.1%, variable X_{29} the number of inadequate equipment that has an effect of 10.2%, variable X_{54} occurrence of work accidents that have an effect of 4.20% and variable X_{35} the insufficient number of experienced personnel which have an influence of 4.2%, and the variable X_{54} inadequate financial availability by the owner who has an influence of 3.8%.

1.3. Managing the risk of the construction process

Risk response planning is the process of developing option, choosing strategies, and agreeing on actions taken to address overall project risk exposures, as well as individual project risks. Effective and appropriate risk response can reduce individual threats and reduce overall project risk exposure. After the risks are identified and analyzed, a risk response plan must be developed. Risk response must be in accordance with the level of risk significance, cost-effective in meeting challenges, realistic. The risk response strategy that can be applied in the overall project [7] is to avoid. If the overall risk level is significantly negative and outside the risk limit, the avoidance strategy can be applied and mitigated. In reducing the risk of actions taken to reduce the possibility of occurrence and / or the impact of threats.

1.4. Apartment project operational performance indicators

Performance is the result of work that has a strong relationship with the organization's strategic goals, customer satisfaction, and contributes to the economy. The performance control process generally consists of three main steps, as follows: a. Set performance standards. This standard can be budgeted costs and schedules. b. Measuring performance against standards by comparing actual performance and performance standards. The results of work and expenses that have occurred compared to the planned schedule and costs. c. Take corrective action if there is a deviation from the standard set. The performance of a building can be measured from the indicators of cost, quality, and time performance by carefully planning, thorough, and integrated all the allocation of resources (human, material and machine) that must be aligned with the goals and objectives of the organization [8].

The operational phase of the apartment building consists of technical and administrative actions aimed at maintaining and restoring the functions of the building as planned previously. The technical action in question are architectural, structural, mechanical, electrical, outside layout, and house keeping. While administrative actions include marketing, finance, and general affair [12]. From the discussion above, the operational performance indicators of apartment projects are the technical and administrative aspects. The apartment project is called to have good operational performance if it meets its technical aspects that can provide security, safety and comfort to its users and is administratively successful in marketing and provides good financial performance for its project owners.

1.5. Recommendation

From the results of risk identification and analysis of the risk variables of the construction process, to achieve the operational performance of the project, management of the risks that have been identified must be carried out.

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Recommendations and improvements given generally consist of efforts to avoid risk or preventive measures to prevent risk by carrying out detailed resource planning so that all stages and activities have been considered, including identified risks that may occur and anticipated steps. Another effort is to take mitigation measures against the risks that have occurred so that the impact can be immediately neutralized.

V. CONCLUSION

From the explanation above, it can be concluded:

1. Risk identification has been carried out in the construction process of an apartment building project in Tangerang that is sourced from a literature study and obtained 75 risk variables of the construction process that could potentially interfere achieving project performance.
2. The results of risk analysis obtained six free risk variables that influence operational performance by forming a regression equation $Y = 0.115 X38 + 0.108 X20 + 0.148 X29 + 0.189 X54 + 0.214 X35 + 0.172 X48 + 0.38$. Y as operational performance in apartment buildings in Tangerang, variable X38 labor-related problems (availability of expert labor, production power, supervisory staff) which have an influence of 48.5%, variable X20 the method of construction / implementation of work that is improper that has an influence of 17.1%, variable X29 the number of inadequate equipment that has an effect of 10.2%, variable X54 occurrence of work accidents that have an effect of 4.20% and variable X35 the insufficient number of experienced personnel which have influence of 4.2%, and variable X54 inadequate financial availability by the owner which has an influence of 3.8%.
3. For an effective and appropriate risk response to reduce individual threats, and reduce the overall risk exposure of the project, the most appropriate risk management strategy must be chosen. Risk response must be in accordance with the level of risk significance, cost-effective in meeting challenges, realistic. The risk responses strategy that can be applied in the overall project are:
 - Avoid. If the overall risk level is significantly negative and outside the risk limit, then avoidance strategies can be applied;
 - Transfer / share. If the overall risk level is high, but the organization cannot cope effectively, then third parties can manage risk on behalf of the organization;
4. The operational performance indicators of the apartment project are the technical and administrative aspects. The apartment project is called to have good operational performance if it meets its technical aspects that can provide security, safety and comfort to its users and is administratively successful in marketing and provides good financial performance for its project owners.
5. To achieve operational performance, construction projects are recommended to manage risk by considering the magnitude and level of importance of the impact that will affect the operational performance of the apartment project.

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