Risk Analysis of The Apartment Construction Project in Superblock Area to Improve Time Performance

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Abstract: Apartment construction projects require certain processes and steps because it is a construction job that carries high risks. It is known that apartment construction work is work that has a high risk, this will increase the risks that exist if apartment construction work occurs in a superblock area due to interactions between one construction project and another construction project. The high risk and uncertainty in apartment construction projects in superblock areas can be one of the causes of project time deviations. One control strategy to minimize the occurrence of time deviations is to detect risks that may occur and review every procedure related to the apartment construction process in the company's superblock area, then categorize high risks so that it can become a reference for each party in controlling apartment construction in the superblock area. This research was carried out with the aim of knowing the risk variables that influence the time performance of apartment construction in the superblock area, to find out the identification of high risks from the variables of the design review process, contractor procurement process, construction execution, maintenance period and handover which influence the construction time performance. apartments in the superblock area to minimize time deviations in the project. Data was obtained from literature study, interviews with experts and respondents. From the answers of 30 respondents, 98 risk factors were identified both in terms of probability and impact. The method used is descriptive analysis, validity & reliability testing, and qualitative risk analysis. This research found 4 variables with the high risks category which impacat to construction delay in building apartments in the superblock area that included suspension of work by owner, mistakes and rework, unreliable subcontractors, and rework due to errors while the rest variables are moderate and low category.

Keywords: Apartment; Superblock Area; Risk; Time Deviasions.

1. INTRODUCTION

Construction is a series of activities to construct, maintain, demolish buildings that are partially and/or completely integrated with the land or whose location is integrated with the land. Furthermore, construction work is all or part of the activities which include construction, operation, maintenance, demolition and rebuilding of a building (Government Regulation No. 14, 2021).

Then construction can be classified into general construction work businesses, namely buildings and civil buildings. General construction work businesses must meet the criteria of being able to work on construction buildings or other physical forms, starting from land preparation to final delivery or functioning of the building (Law No. 22, 2017).

A building is a physical form resulting from construction work that is integrated with its location, partly or wholly on and/or in the ground and/or water, which functions as a place for humans to carry out their activities, whether for housing or residence, religious activities, activities business, social, cultural and special activities (Government Regulation No. 16, 2021).

Then buildings can be classified into class 1 in the form of ordinary residential buildings; class 2 consists of residential buildings consisting of 2 or more residential units, each of which is a separate residence; class 3 in the form of a mixed residential building located within a class 5, 6, 7, 8, or 9 building and is a residence within that building; class 4 in the form of a mixed residential building located within a class 5, 6, 7, 8, or 9 building and is a residence within that building; class 5 in the form of office buildings used for professional business purposes, administrative management or commercial businesses outside class 6, 7, 8, or 9 buildings; class 6 in the form of commercial buildings used for retail sales of goods or services directly to the public; class 7 in the form of storage buildings used for storage; class 8 in the form of laboratory/industrial/factory buildings used for processing a product, assembling, altering, repairing, packing, finishing or cleaning production goods for the purpose of trading or selling; class 9 in the form of public buildings used to serve the needs of the general public; class 10 in the form of buildings or structures that are not for residential purposes (Australian Building Codes Board of Australia, 2022).

In this research, the main focus is meant by buildings closer to apartments, namely residences in multi-family housing buildings that have several features of single-family housing units to improve the quality of change in urban areas (Stoiljkovic, 2020).

Then the apartments will be built in a special area in the form of a superblock area, namely main roads that are divided into urban blocks by local roads (Peponis, 2015).

The elements that are the main focus are in the superblock area in the form of apartments, where in the superblock area there are elements such as residential zones in the form of apartments, office zones in the form of offices, and shopping area zones in the form of shopping malls (Titarenko, 2018).

This research case study takes the research object of apartments in the superblock area in Jakarta-Bogor-Depok-Tangerang-Bekasi (Jabodetabek). The scope includes apartments in the Bintaro superblock area, the Cibubur superblock area and the Juanda superblock area developed by PT. X as owner. Of the three apartment developments in the superblock area, the Juanda superblock area was designated as a case study in this research because the Bintaro superblock area and the Cibubur superblock area have completed the construction process.

1.1 Construction

The success of construction project management is based on three main factors, namely time, cost and quality. Time and cost are the lifeline of any and every project. The success or failure of any project largely depends on these two factors apart from its quality. It is a rare sight in the construction industry that projects are completed well within the estimated budget and time and with the desired quality. There is the involvement of several skills, equipment, machines and materials. The dependence on a number of interrelated activities makes construction a complex process. And if the industry is largely unorganized, this will further exacerbate this problem (Mulla, 2015).

Construction projects are complex activities involving many participants with different goals. They are generally considered to be long-term projects that are subject to a varying range of risks and uncertainties over their life cycle (Keci, 2013).

Change orders have long been an inherent part of the construction industry. It is rare to find a construction project implemented without changes which usually arise as a result of several causes caused by various parties involved in the project execution. After acknowledging its existence, changes or variations are formally regulated by the issuance of a change order which is a document that describes the scope of the change and its impact on both cost and/or time. If no agreement is reached between the project parties on the change, it will turn into a claim or dispute that may have a negative impact on project implementation. Although most construction projects are government owned, there are difficulties in obtaining such data on change orders taking into account the provisions and regulations that apply therein. Furthermore, although the implementation of all projects both public and private is carried out by the private sector, the release of data in connection with change orders is also faced with confidentiality issues considering the high competition in the market. After identifying such serious deficiencies in the change order data, it was decided to survey the personnel involved in the construction industry represented by the three major parties; owner, consultant and contractor (Alaryan, 2014).

The rapid increase in the problem of delayed or late payments has now reached a point where it tends to reduce the good image of the construction industry and is considered a significant factor of concern for all parties in the industry. It should be stipulated that in the event that the owner or developer fails to make progress payments to the contractor within the time specified in the contract, by notifying the owner, the contractor may urge the owner to make progress payments. If the owner still fails to pay after receiving the contractor's notice, the owner may negotiate with the contractor for deferred payment terms. If the owner and contractor reach an agreement, the owner must pay interest on the overdue account. However, if both parties fail to reach an agreement and the contractor cannot continue his work, the contractor can suspend his work and the owner must bear his responsibility for breach of contract (Ansah, 2011).

One of the main goals and policies of any public or private sector dealing with project implementation is to improve project performance through reducing costs, completing projects within allocated budget and time constraints, and improving quality. It is also important to note that completion time is very important in construction (Oklobia, 2022).

1.2 Superblock

Superblocks are main streets divided into urban blocks by local streets. It can be seen that the area of the superblock is quite consistent (between 64 and 70 hectares) as is the distance of the main arterial road (between 804 and 866 meters). Road lengths per hectare range from 140 to 320 meters, and internal block areas range between 0.5 and 3 hectares – note that block areas are measured from the center line of the road and thus need to be exaggerated by the width of the roads surrounding the blocks (Peponis, 2015)

The elements in the superblock consist of (Titarenko, 2018): Mall, namely a shopping complex located in a building and managed as a single property (Tsimonis, 2014); The campus is an educational environment that is penetrated by enabling technological improvements for intelligent services for educational performance while meeting stakeholders, with extensive interaction with other interdisciplinary domains in the context of smart cities (Dong, 2019); Shop House, which has either a residential front or a shop front on the first floor, depending on the use of the original building (Urban Redevelopment Authority of Singapore, 2022); Apartments, namely residences in multi-family housing buildings that have several features of single-family housing units to improve the quality of change in urban areas (Stoiljkovic, 2020); Waterpark, namely an amusement park that features water play areas, such as water slides, splash pads, splash pads (water play areas), lazy rivers, wave pools, or other recreational bathing, swimming, and barefoot environments (Promise, 2021); A hotel is an establishment that provides short-term paid accommodation (Institute of Company Secretaries of India, 2021).

1.3 Risk

The definition of risk is an uncertain event or a condition that occurs that has a positive or negative effect on project objectives (Project Management Body of Knowledge, 2021).

Each project has its own risks, either as a result of technical aspects or as a result of the procedures and sequence of project implementation. Therefore, risks must be managed by first identifying them, setting priorities, and then finding solutions according to the type of activity, their likelihood of occurrence, and their potential impact on the project. This must be followed by a periodic and appropriate follow-up phase for each item, which will have a high impact on the project with certainty of the distribution of responsibility and authority for each item that will have a high impact on the project (El-Reedy, 2011).

In practice, it is known that projects tend to exhibit cost overruns and schedule delays, leading to failure and leading to collapse. Under these conditions the application and improvement of project risk management becomes very

important, which is a key challenge for scientific research. Modification of key risks during a project requires an iterative risk management process that is carried out throughout the life cycle and takes into account the specific project objectives and circumstances (Keci, 2013).

If risks are not analyzed properly, and strategy is not handled properly, a project is likely to fail. For example, one common risk in construction projects is rising prices of building materials. In actual practice, new rates will usually be priced after the work is completed based on actual costs. Additionally, these increased costs are passed on to the contractor, including quotations for all estimated costs, delays, disruptions, and risks. During the construction phase of an office building project, it is impossible to avoid these risks. Still, any risk has a significant impact if not prevented on time, at least leading to considerable disruption of delays in the project. Some reasons for risk on construction sites stem from objective reasons such as lack of experience of workers or construction staff, incomplete design, lack of careful planning at the design stage, lack of expert coordination, and delays in clarifying complicated detailed activities (Nguyen, 2020).

Risk management is a form of decision making in project management and is an important part of the project management plan; it describes the type, source and impact of potential risks in the project. Furthermore, the aim of the risk management process is to identify risks, predict, assess frequency and impact, in addition, tools and techniques will be used in risk identification, classification and assessment (Chaher, 2016).

Risks associated with the construction industry can be broadly categorized into (Mhetre, 2016): technical risks is risks associated with incomplete design, inadequate specifications, inadequate site investigations, changes in scope, construction procedures and inadequate availability of resources etc.; construction risks is these risks include labor productivity, labor disputes, site conditions, equipment failure, design changes, too high quality standards and new technology; physical risks is risks arising from damage to structures, equipment damage, labor injuries, equipment & material fire and theft, etc.; organizational risk is organizational risk consists of contractual relationships, contractor experience, participant attitudes, inexperienced workforce and communications; financial risks: Increased material costs, low market demand, exchange rate fluctuations, late payments and inaccurate tax estimates etc; socio-political risks is changes in legislation, pollution and safety regulations, bribery/corruption, language/cultural barriers, law & order, war and civil unrest and permit and approval requirements; environmental risk is natural disasters and weather changes.

2. METHODS

The method that was used by researches is riskd-based analysis. Then the data is processed quantitatively to get the level of risk. The risk level wias analyzed where the sub-variable items only have extreme and high-risk categories.

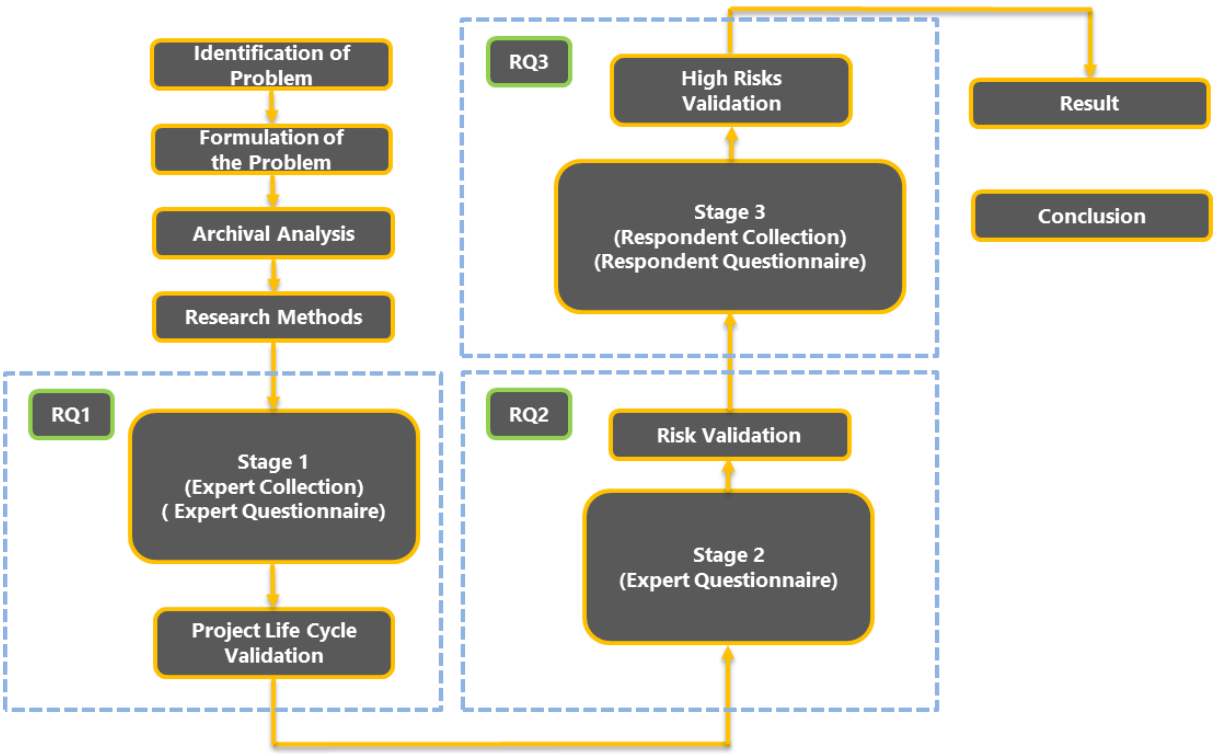

Figure 1. Research Flow Diagram

A variable is an image, perception, or concept that can be measured. In other words, a concept that can be measured is a variable (Kumar, 2011).

In this research, what is used as the Y variable (dependent variable) is the time performance of the apartment construction project in the superblock area. Meanwhile, variable X (independent variable) is the risk factors in apartment construction projects in the superblock area. Because based on existing considerations, the scope used in this research includes the design review process through to

project handover. Next, the author modified the indicators of risk factors through a literature study by adding indicators to risk factors that only occur in superblock development projects, as well as drawing conclusions from similar indicators stated by more than one author.

To achieve the objectives of the research, the author conducted interviews and discussions with various respondents and experts. Thus found there are 103 risk factors are consist of:

Table 1. Variable Component of Review

Stage	Risk Factors that Affect Project Performance		Reference
Review Design Process	X1	Complexity of project design	Tessema, 2022
	X2	Design changes by owner or his agent during construction	Nguyen, 2021
	X3	Design errors and omissions made by designers	Cheng. 2021
	X4	Insufficient data collection and survey before design	Cheng, 2021
	X5	Lack of design team experience in construction projects	Safaeian, 2022
	X6	Mistakes and delays in producing design documents	Tarihoran, 2019
	X7	Misunderstanding of owner's requirements by design engineer	Nguyen, 2021
	X8	Poor use of advanced engineering design software	Safaeian, 2022
	X9	Unclear and inadequate details in drawings	Nguyen, 2021
	X10	Incomplete project design	Nguyen, 2021
	X11	Defective design made by designers	Tarihoran, 2019

Stage	Risk Factors that Affect Project Performance		Reference
Contractor Procurement Process	X12	Frequent change of subcontractors	Aziz, 2013
	X13	Inadequate contractor experience	Cheng, 2021
	X14	Inappropriate construction methods	Cheng, 2021
	X15	Incompetent project team	Safaeian, 2022
	X16	Ineffective project planning and scheduling	Safaeian, 2022
	X17	Obsolete technology	Aziz, 2013
	X18	Poor communication and coordination between owner and consultant	Nguyen, 2021

Stage	Risk Factors that Affect Project Performance		Reference
Contractor	X19	Poor site management and supervision	Safaeian, 2022

Procurement Process	X20	Rework due to errors	Cheng, 2021
	X21	Unreliable subcontractors	Aziz, 2013
	X22	Inadequate site investigation	Chandubhai, 2019
	X23	Inappropriate contractor's policies	Cheng, 2021
	X24	Poor financial control on site	Cheng, 2021

Stage	Risk Factors that Affect Project Performance		Reference
Construction Execution	X25	Equipment allocation problem	Alaryan, 2014
	X26	Frequent equipment breakdowns	Oklobia, 2022
	X27	Improper equipment	Tessema, 2022
	X28	Inadequate modern equipment	Aziz, 2013
	X29	Low efficiency of equipment	Aziz, 2013
	X30	Lack of equipment	Cheng, 2021
	X31	Slow mobilization of equipment	Aziz, 2013
	X32	Accidents during construction	Tessema, 2022
	X33	Changes in government regulations and laws	Tessema, 2022
	X34	Different tactics patterns for bribes	Mhetre, 2016
	X35	Delay in obtaining permits from municipality	Oklobia, 2022
	X36	Delay in performing final inspection and certification by third party	Marzouk, 2014
	X37	Delay in providing services from utilities (water, electricity, etc.)	Marzouk, 2014
	X38	Global financial crisis	Aziz, 2013
	X39	Loss of time by traffic control and restriction at site	Marzouk, 2014
	X40	Sudden failures actions	Aziz, 2013
	X41	Price fluctuations	Cheng, 2021
	X42	Problem with neighbors	Marzouk, 2014

Stage	Risk Factors that Affect Project Performance		Reference
Construction Execution	X43	Slow site clearance	Aziz, 2013
	X44	Unexpected surface& subsurface conditions (soil, water table, etc.)	Marzouk, 2014
	X45	Unfavorable weather conditions	Cheng, 2021

	X46	Inadequate production of raw material in the country	Tarihoran, 2019
	X47	Inappropriate government policies	Aziz, 2013
	X48	Thefts done on site	Aziz, 2013
	X49	Absenteeism	Aziz, 2013
	X50	Low motivation and morale of labor	Sigmund, 2014
	X51	Low productivity of labor	Tessema, 2022
	X52	Personal conflicts among labor	Tessema, 2022
	X53	Shortage of labor	Marzouk, 2014
	X54	Slow mobilization of labor	Oklobia, 2022
	X55	Labor strikes due to revolutions	Tessema, 2022
	X56	Unqualified/inadequate experienced labor	Oklobia, 2022
	X57	Labor injuries on site	Mhetre, 2016
	X58	Changes in material types and specifications during construction	Cheng, 2021
	X59	Damage of sorted materials	Tarihoran, 2019
	X60	Delay in manufacturing materials	Tarihoran, 2019
	X61	Escalation of material prices	Cheng, 2021
	X62	Late delivery of materials	Cheng, 2021
	X63	Poor procurement of construction materials	Tarihoran, 2019
	X64	Poor quality of construction materials	Tarihoran, 2019
	X65	Shortage of construction materials	Tarihoran, 2019
	X66	Unreliable suppliers	Chaher, 2016
	X67	Complexity of project (project type, project scale, etc.)	Tessema, 2022
	X68	Inadequate definition of substantial completion	Tessema, 2022
	X69	Ineffective delay penalties	Mulla, 2015

Stage	Risk Factors that Affect Project Performance		Reference
Construction Execution	X70	Legal disputes between project participants	Nguyen, 2021
	X71	Original contract duration is short	Oklobia, 2022
	X72	Unfavorable contract clauses	Akinsiku, 2016
	X73	Change orders	Cheng, 2021

	X74	Conflicts between joint-ownership	Nguyen, 2021
	X75	Delay in approving design documents	Tarihoran, 2018
	X76	Delay in progress payments (Funding problems)	Tessima, 2022
	X77	Delay in site delivery	Oklobia, 2022
	X78	Improper project feasibility study	Safaeian, 2022
	X79	Lack of capable representative	Safaeian, 2022
	X80	Lack of owner experience in construction projects	Safaeian, 2022
	X81	Lack of incentives for contractor to finish ahead of schedule	Aziz, 2013
	X82	Poor communication and coordination between consultant and contractor	Nguyen, 2021
	X83	Slowness in decision making	Soliman, 2018
	X84	Suspension of work by owner	Soliman, 2018
	X85	Inadequate planning	Nguyen, 2021
	X86	Mode of financing and payment for completed work	Soliman, 2018
	X87	Long period between design and time of bidding/tendering	Aziz, 2013
	X88	Inappropriate contractual procedure	Cheng, 2021
	X89	Additional work	Mulla, 2015
	X90	Bureaucracy in bidding/tendering method	Cheng, 2021
	X91	Selecting inappropriate contractors	Aziz, 2013

Stage	Risk Factors that Affect Project Performance		Reference
Maintenance Period	X92	Lack of manpower staff to direct work	Soliman, 2018
	X93	Decision not taken in the proper time	Soliman, 2018

Stage	Risk Factors that Affect Project Performance		Reference
Maintenance Period	X94	Change order during work implementing	Soliman, 2018
	X95	No prior work order budget estimate	Soliman, 2018

Stage	Risk Factors that Affect Project Performance		Reference
Handover	X96	Mistakes and rework	Cheng, 2021
	X97	A dispute between the parties	Nguyen, 2021

Stage	Risk Factors that Affect Project Performance		Reference
Only Occurs in Superblock Projects	X98	A problem with one is a problem with the other	Dupois, 2003
	X99	Two different teams	Dupois, 2003
	X100	Legal issues	Dupois, 2003
	X101	Development finance for mixed-use projects is often limited as such projects are deemed to be higher risk profiles	Wardner, 2014
	X102	Property cycles of each subsector is difficult to align	Wardner, 2014
	X103	Construction and management of mixed-use requires a level of experience and specialization	Wardner, 2014

An appropriate research strategy needs was planned to obtain research results that are in line with the expectations and objectives of the research itself. Research strategies can be divided into 5 types based on the type of questions used, control over the events being studied, and focus on ongoing/recently completed events (Yin, 2018).

Initial Expert Validation Questionnaire (used to answer RQ1, RQ2). The expert provisions included in this research are:

Experts from specialized fields have a minimum of Diploma and Bachelor's degrees who have at least 10 years of work experience in handling high rise building construction projects and have a good reputation.

It is known in this research that the profile of experts who are willing to become experts is that there are 3 experts from the contractor's agency who have positions as directors who have education in the form of diplomas and bachelor degrees. Then there were also 2 experts from the owner's agency who had positions as project manager and construction manager who had master's and bachelor's degrees.

Next, the research strategy used to be described based on each problem formulation/research question (RQ), as follows:

RQ1: What are the stages and activities in the life cycle of an apartment development project in a superblock area? To answer RQ1, the research strategy chosen was archival analysis, starting with a literature study, which was used to obtain an overview/become input for the author regarding the stages and activities in the life cycle of apartment development projects in the superblock area. The indicators that have been obtained are then validated by experts, so that they become stages and activities in the life cycle so that risk factors can be applied.

Expert validation, which aims to validate the business processes and activities in each business process. In this case, interviews was conducted with 5 experts at the company that owns PT. X so that it was produced an expert judgment.

Stage 1 data collection was carried out by administering a questionnaire to validate the results of the analysis in the previous phase, namely a matrix that had been prepared showing the project business process and its activities.

It is known that this research has obtained results from RQ1 which include business processes in the form of a design review process, contractor procurement process, construction execution, maintenance period and handover, all of which have been validated by experts.

Then from RQ1 we have also obtained activities from each business process, namely in the design review process business there are 5 activities, the contractor procurement process there are 5 activities, the construction execution there are 3 activities, the maintenance period there is 1 activity, and the handover there are 2 activities, all of which are has been validated by experts.

RQ2: What are the risk factors that can influence each stage of the life cycle of an apartment development project in a superblock area that can affect time performance? To answer RQ2, the research strategy chosen was archival analysis, starting with a literature study, which was used to obtain an overview/become input for the author regarding risk factors in apartment development projects in the superblock area. The indicators that have been obtained are then validated by experts, so that they become risk factors so that the level of risk can be determined.

Expert validation, which aims to validate the risk factors of each activity in the business process. The experts addressed are the same as the experts in the stage 1 questionnaire.

Stage 2 data collection was carried out by administering a questionnaire to validate the results of determining risk factors for each activity in the business process. After validation of business processes and activities, the results was filled in for each risk factor then be validated by experts. At this stage, the expert was agreed or disagree with the risk factors that have been written. If the expert disagrees or has another opinion, the expert can write it in the column provided.

It is known that this research obtained results from RQ2 which includes risk factors that occur in apartment construction projects in superblock areas which influence time performance, all of which have been validated by experts.

Then from RQ2 the risks from each business process are also obtained, namely in the design review process business there are 11 risks, the contractor procurement process is 13 risks, the construction execution is 67 risks, the maintenance period is 4 risks, and the handover is 2 risks and there are additional in the form of risks that only occur in the

superblock project, there are 6 risks, all of which have been validated by experts.

RQ3: How to carry out an analysis to obtain a high risk of delays in apartment development projects in superblock areas? To answer RQ3, the research strategy chosen was archival analysis, starting with a literature study, which was used to obtain an overview/become input for the author regarding high risk factors in apartment development projects in the superblock area. The indicators that have been obtained are then validated by the respondents, so that they become high risk factors so that risk responses can be sought.

Pilot survey, which aims to adjust the delivery used to respondents so that it is easier for respondents to understand so that the intent of the survey can be achieved. The pilot survey was aimed at 5 potential respondents, after obtaining the results from the potential respondents' answers that were in accordance with research needs, the results of the 5 potential respondents were approved and considered valid as respondents' answers. The respondent questionnaire was carried out with the aim of collecting respondents' opinions in assessing the frequency and impact of each risk factor, so that the level of each risk factor can be known and high risk factors can be identified and responses must be made to these risks.

The pilot survey was carried out to adjust the delivery used to respondents so that it is easier for respondents to understand so that the intent of the survey can be achieved. The pilot survey was aimed at 10 potential respondents.

After obtaining the results from the answers of potential respondents that were in accordance with research needs, the results of the 10 potential respondents were approved and considered valid as respondents' answers.

When collecting respondent data, respondents' opinions wias collected regarding the opportunity assessment (frequency) and impact of each risk factor variable. At this stage, data collection was carried out with a minimum number of respondents of 30 respondents.

In the questionnaire that was distributed to respondents, the research scale that wias used is the measurement index scale with point 1 representing a very low value and point 5 representing a very high value. This research scale was used to measure the frequency and impact of each indicator so that it can identify dominant risk factors.

Pilot survey and respondent questionnaire (used to answer RQ3). The conditions for respondents included in this study are:

Respondents from specialized fields have a minimum of a Diploma or Bachelor's degree, have at least 2 years of work experience in handling high rise building construction projects and have a good reputation.

It is known in this research that from the profile of the respondents, those who were willing to become respondents were 30 respondents from the owner's agency who had positions as directors, managers, inspectors, supervisors, engineers, and staff who had education in the form of diplomas and bachelor degrees.

2.1 Validity and Reability Test

The validity test is carried out to determine the suitability of the question items in a list of questions in defining a variable. The basis for decision making in the validity test is that if the calculated r value > r table, then the question items or statements in the questionnaire are significantly correlated with the total score (valid). Then if the calculated r value < r table, then the question items or statements in the questionnaire do not correlate significantly with the total score (invalid).

Reliability testing is carried out to determine the extent to which a variable can be trusted or relied upon. The basis for decision making in the reliability test is that if the Cronbach's Alpha value is > 0.60 then it is reliable, but if the Cronbach's Alpha value is < 0.60 then it is not reliable.

It is known that after carrying out the validity test and reliability test, the results were obtained in the design review process, there were 11 risks that got valid results in the validity test and reliable results in the reliability test, in the contractor procurement process there were 13 risks that got valid results in the validity test and reliable results in the test. reliability, construction execution there are 62 risks that get valid results in the validity test and reliable results in the reliability test where for 5 risks they don't get expert validation from the RQ2 results, during the maintenance period there are 4 risks that get valid results in the validity test and reliable results in the reliability test , in the handover there are 2 risks that get valid results in the validity test and reliable results in the reliability test, and only in the superblock project there are 6 risks that get valid results in the validity test and reliable results in the reliability test.

2.2 Qualitative Risk Analysis

After carrying out statistical tests, the results of variable X become input into the risk ranking analysis. Based on the results of the literature study that has been carried out, it was found that factors have the potential to cause risks in controlling apartment construction in the superblock area starting from the design review process, contractor procurement process, construction execution, maintenance period and handover.

The number of variables to be analyzed is 98 X variables. Risk ranking analysis is carried out by calculating the average value of risk frequency and impact which has been weighted based on the probability and impact matrix. The average value of risk frequency and impact will be multiplied (Risk = Frequency x Impact) to get the risk value. Next, the risk values will be sorted and given a risk rating (High Risk, Moderate Risk, Low Risk).

The following are the results of the frequency and impact tabulation which shows the number of answers to each question from all respondents.

From the results of the frequency data tabulation which consists of 5 low to high frequency scales, namely almost never happens, rarely happens, can happen occasionally, happens often, and almost happens all the time, so it is known which risk variables have been determined in RQ2 from low to The height is presented from the number of respondents who chose compared to the frequency scale.

Likewise, the tabulated results of impact data consist of 5 scales of low to high impact, namely 1 week late (no influential), 1-4 weeks late (less influential), 1-3 months late (quite influential), 3-6 months late (influential), and more than 6 months late (very influential) so that it is known which risk variables have been determined in RQ2 from low to high which are presented from the number of respondents who chose them compared to the impact scale.

After tabulating the impact and risk values, the average value for each impact and risk is then calculated. The following is a tabulation of the average risk frequency calculation.

After getting the results from the tabulation of frequency and impact data, it is necessary to calculate the risk, namely multiplying the average frequency and the average impact so that the risk results for each risk variable are obtained and the risk categories are also categorized based on the frequency and impact risk table.

It is known from the average multiplication between frequency and impact that for risk variables in the high category there are 4 risk variables, in the moderate category there are 59 risk variables, and in the low category there are 35 risk variables.

Based on the calculation results of calculating the average frequency and impact values, a recapitulation of risk level and ranking calculations is obtained which is the result of multiplying the average frequency value and the average impact value. The results of the multiplication are grouped according to the numbers in the risk matrix table. The following are the results.

Almost happens all the time	**Very High 0,90**	**0,05**	**0,09**	**0,18**	**0,36**	**0,72**
Happens often	**High 0,70**	**0,04**	**0,07**	**0,14**	**0,28**	**0,56**
Can happen occasionally	**Moderate 0,50**	**0,03**	**0,05**	**0,10**	**0,20**	**0,40**
Rarely happening	**Low 0,30**	**0,02**	**0,03**	**0,06**	**0,12**	**0,24**
Almost never happens	**Very Low 0,10**	**0,01**	**0,01**	**0,02**	**0,04**	**0,08**
		Very Low 0,05	**Low 0,10**	**Moderate 0,20**	**High 0,40**	**Very High 0,80**
		No influential	**Less influential**	**Quite influential**	**Influential**	**Very influential**

Figure 2. Frequency and Impact Risk

3. RESULT

The result of a survey of 30 respondents showed that review design process, contractor procurement process, consruction execution, maintenance period, and handover variables had an impact on time performance at the apartment construction process in the superblock area.

Variables X has 5 sub-variables, where the question given to respondents are asked to sort the frequency and impact values starting from those that have an effect to those that have less influence on the performance of time period. The researcher used the criteria ideal score formula to obtain the risk level.

Table 2. Risk Categories for Design Review Process

Risk Variable	Risk Percentage	Risk Category
X1	89%	Moderate
X2	85%	Moderate
X3	88%	Moderate
X4	85%	Low
X5	88%	Moderate
X6	93%	Moderate

Risk Variable	Risk Percentage	Risk Category
X7	91%	Low
X8	89%	Low
X9	80%	Moderate
X10	80%	Moderate
X11	90%	Moderate

It is known from the table that it is variable X6 with a percentage of 93% which represents the moderate category and variable X7 with a percentage of 91% which represents the low category.

Table 3. Risk Categories for Contractor Procurement Process

Risk Variable	Risk Percentage	Risk Category
X12	89%	Moderate
X13	85%	Moderate
X14	88%	Moderate
X15	85%	Moderate
X16	88%	Moderate
X17	93%	Moderate
X18	91%	Moderate

Risk Variable	Risk Percentage	Risk Category
X19	89%	Moderate
X20	80%	High
X21	80%	High
X22	90%	Moderate
X23	88%	Moderate
X24	88%	Moderate
X18	91%	Moderate

In the sub-category of the contractor procurement process, the variable X20 with a percentage of 80% and the variable X21 with a percentage of 80% are obtained, which represents the high category.

Table 4. Risk Categories for Construction Execution

Risk Variable	Risk Percentage	Risk Category
X25	95%	Low
X26	92%	Moderate
X27	94%	Low

X28	95%	Low
X29	94%	Low

X50	97%	Low
X51	93%	Low

Risk Variable	Risk Percentage	Risk Category
X30	89%	Moderate
X31	93%	Moderate
X32	94%	Low
X33	92%	Moderate
X35	91%	Moderate
X36	94%	Low
X37	94%	Low
X38	89%	Moderate
X39	97%	Low
X40	95%	Low
X42	96%	Low
X43	96%	Low
X44	87%	Moderate
X45	92%	Moderate
X46	88%	Moderate
X47	91%	Moderate
X48	95%	Low
X49	96%	Low

Risk Variable	Risk Percentage	Risk Category
X52	98%	Low
X53	92%	Moderate
X54	94$	Low
X55	92%	Moderate
X56	94%	Low
X57	96%	Low
X58	86%	Moderate
X59	93%	Moderate
X60	90%	Moderate
X61	92%	Moderate
X62	93%	Low
X63	94%	Low
X64	93%	Low
X65	91%	Moderate
X66	91%	Moderate
X67	96%	Low
X68	95%	Low
X70	92%	Moderate

X71	94%	Low
X72	94%	Low

Risk Variable	Risk Percentage	Risk Category
X73	91%	Moderate
X74	86%	Moderate
X75	92%	Moderate
X76	88%	Moderate
X77	89%	Moderate
X78	97%	Low
X79	95%	Low
X80	95%	Low
X82	95%	Low
X83	92%	Moderate
X84	78%	High
X85	92%	Moderate
X86	92%	Moderate
X87	92%	Moderate
X88	92%	Moderate
X89	88%	Moderate
X91	92%	Moderate

Meanwhile, in the construction execution sub-category there are all types of risk categories, namely variableX84 with a percentage of 78% representing the high category, variable X62 with a percentage of 93% representing the moderate category, and variable X39 with a percentage of 97% representing the low category.

Table 5. Risk Categories for Maintenance Period

Risk Variable	Risk Percentage	Risk Category
X92	94%	Low
X93	91%	Moderate
X94	84%	Moderate
X95	92%	Moderate

For the maintenance period sub-category, there are only 2 types of risk categories, namely variable X95 with a percentage of 92% which represents the moderate category and variable X92 with a percentage of 94% which represents the low category.

Table 6. Risk Categories for Handover

Risk Variable	Risk Percentage	Risk Category
X96	79%	High
X97	84%	Moderate

Then in the handover sub-category, another high risk category was obtained, namely variable X96 with a percentage of 79%.

Table 7. Risk Categories for Only Happens in Superblock Projects

Risk Variable	Risk Percentage	Risk Category
X98	91%	Moderate
X99	93%	Low
X100	90%	Moderate

X101	92%	Moderate
X102	94%	Low
X103	90%	Moderate

But it is very unfortunante that this sub-category only occurs in superblock projects did not get the high risk category, namely variable X101 with a percentage of 94% representing the moderate category and variable X102 with a percentage of 94% representing the low category.

4. DISCUSSION

4.1 Business Processess and Activities in the Apartment Construction Project in Superblock Area

Business Processes in the apartment construction process in the superblock area are 5 processes, consisting of 1 processes at the design review process stage, 1 processes at the contractor procurement process stage, 1 processes at the construction execution stage, 1 processes at the maintenance period stage, and 1 processes at the handover stage;

There are 16 activities in the apartment construction process in the superblock area, consisting of 5 processes at the design review stage, 5 processes at the contractor procurement stage, 3 processes at the construction execution stage, 1 processes at the maintenance period stage, and 2 processes at the handover stage.

4.2 Risks the Apartment Construction Project in Superblock Area

After obtaining each activity that was used as an instrument in controlling apartment construction in the superblock area is identified. Then, after conducting a literature study, it was found that 98 risk factors had an influence on project time performance. After analysis using SPSS and Qualitative Risk Analysis, as well as final validation by experts, where all risk factors are valid, with 4 Risk Factors included in the High Risk category, which consists of: Suspension of work by the owner, Mistakes and rework, Unreliable subcontractors, Rework due to errors.

Then it was also found from the research that there was 59 moderate risk category consist of: Dispute between the parties, Change order during work implementing, Inadequate contractor experience, Incompetent project team, Design changes by owner or his agent during construction, Conflicts between joint-ownership, Changes in material types and specifications during construction, Unexpected surface & subsurface conditions (soil, water table, etc.), Inappropriate construction methods, Poor financial control on site, Ineffective project planning and scheduling, Inappropriate contractor's policies, Additional work, Delay in progress payments (Funding problems), Inadequate production of raw material in the country, Frequent change of subcontractors, Global financial crisis, Delay in site delivery, Poor site management and supervision, Low efficiency of equipment, Incomplete project design, Mistakes and delays in producing design documents, Delay in manufacturing materials, Legal issues, Inadequate site investigation, Construction and management of mixed-use requires a level of experience and specialization, Poor communication and coordination between owner and consultant, Change orders, Complexity of project design, Design errors and omissions made by designers, Unreliable suppliers, Delay in obtaining permits from municipality, Inappropriate government policies, Decision not taken in the proper time, Problem with one is a problem with the other, Shortage of construction materials, Labor strikes due to revolutions, Development finance for mixed-use projects is often limited as such projects are deemed to be higher risk profiles, No prior work order budget estimate, Delay in approving design documents, Unclear and inadequate details in drawings, Unfavorable weather conditions, Selecting inappropriate contractors, Shortage of labor, Inadequate planning, Mode of financing and payment for completed work, Escalation of material prices, Defective design made by designers, Changes in government regulations and laws, Long period between design and time of bidding/tendering, Slowness in decision making, Frequent equipment breakdowns, Legal disputes between project participants, Inappropriate contractual procedure, Lack of design team experience in construction projects, Late delivery of materials, Obsolete technology, Slow mobilization of equipment, Damage of sorted materials.

Apart from that, the 35 Low Risk categories consist of: Two different teams, Low productivity of labor, Poor quality of construction materials, Misunderstanding of the owner's requirements by the design engineer, Poor procurement of building materials, Improper equipment, Delays in carrying out final inspection and certification by third parties, Original contract duration was short, Slow mobilization of labor, Unqualified/inadequate experienced workforce, Property cycles of each subsector are difficult to reconcile, Delays in providing services from utilities (water, electricity, etc.), Low equipment efficiency, Lack of staff to direct the work, Accidents during construction, Unfavorable contract clauses, Poor communication and coordination between consultants and contractors, Equipment allocation problems, Insufficient modern equipment, Sudden failure actions, Inadequate modern equipment, Theft done on site, Lack of owner experience in construction projects, Inadequate definition of substantial completion, Lack of capable representatives, Problems with neighbors, Labor injuries on site, Complexity of project (project type, project scale, etc.), Poor use of advanced engineering design software, Slow site clearance, Sudden failures actions, Low motivation and morale of labor, Improper project feasibility study, Loss of time by traffic controls and restrictions at job site, Personal conflicts among labor.

Where there are invalid risk variables for the apartment construction project in the superblock area which affect time performance, namely: Different tactics patterns for bribes, Price fluctuations, Ineffective delay penalties, Lack of incentives for contractor to finish ahead of schedule, Bureaucracy in bidding/tendering method.

5. CONCLUSION

This research was carried out by going through several stages in an effort to develop a guideline that was used as a reference in the process of controlling apartment construction in the superblock area for the owner company. Based on the results of a study of literature which were then validated by experts from the company, the company owner of PT. X there are 5 business processes and 16 activities related to the apartment construction process in the superblock area starting

from the design review process, contractor procurement process, construction execution, maintenance period and handover. The explanation is as follows: The design review process stage consists of 1 business process and 5 activities; The contractor procurement process stage consists of 1 business process and 5 activities; The construction execution phase consists of 1 business process and 3 activities; The maintenance phase consists of 1 business process and 1 activity; The handover stage consists of 1 business process and 2 activities.

After obtaining each activity that was used as an instrument in controlling apartment construction in the superblock area is identified. Then, after conducting a literature study, 103 risk factors were obtained that had an influence on project time performance. After analysis using SPSS and Qualitative Risk Analysis, as well as final validation by experts, where all risk factors are valid, with 4 risk factors included in the High Risk category, 59 factors included in the Moderate Risk category, and 35 risk factors included in the Low Risk category

The handling of each risk factor is for those included in the high risk category which is mapped into each business process and activity so that the instruments for controlling risk factors are known, especially for high category risks. All results from the research are presented in the form of apartment construction control procedures in the superblock area for the company.

By carrying out this research, in the future deviations from the start and end times of projects can be reduced because all owners involved in the project can use this research as a guideline in the process of controlling apartment construction in the superblock area. Every risk factor, especially those in the high category, can be mitigated from the start by controlling every detail of the activity stage. That way, indirectly wasted time that may be experienced due to risks that occur can be avoided or minimized.

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