# Risk Management Analysis of Building Construction Project in the Jakarta City

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**ABSTRAK**

Proyek pembangunan gedung adalah salah satu proyek yang memiliki risiko yang sangat tinggi dalam pelaksanaannya berdasarkan beban pekerjaan dan juga ketinggian struktur bangunannya. Pelaksanaan proyek ini membutuhkan waktu yang lama dengan tingkat komplektisitas yang tinggi sehingga menimbulkan ketidakpastian dilapangan serta mengakibatkan munculnya berbagai macam risiko pada pelaksanaannya. Manajemen risiko harus diterapkan pada tahap awal untuk pengembangan proyek, manajemen risiko akan sangat berguna dalam mengembangkan pemahaman tentang ketidakpastian proyek. Sangat penting untuk memahami konsep manajemen risiko sebelum memahami risiko dalam industri konstruksi bangunan. Penelitian ini bertujuan untuk memperoleh faktor-faktor risiko dominan yang paling berpengaruh dalam proyek konstruksi bangunan dengan menggunakan Metode Relative Important Index (RII). Metode RII digunakan untuk melihat faktor risiko terbesar. Data primer penelitian diperoleh dengan mengisi kuesioner faktor risiko oleh 32 responden dengan posisi Konsultan, Kepala Ahli, Manajer Proyek, dan Manajer Lokasi. Hasil penelitian menunjukkan bahwa Peristiwa yang termasuk dalam kategori risiko tinggi adalah sebagai berikut; kurangnya gambar detail, perubahan desain, desain dan gambar tidak sesuai dengan bill of quantity, jumlah tenaga kerja yang berubah-ubah, kurangnya ketersediaan pekerja di lapangan, kurangnya kontrol dan koordinasi di lapangan, penambahan lingkup pekerjaan, ketidakakuratan dan ketidakcocokan spesifikasi detail pada desain, kurangnya keahlian pekerja dan kurangnya staf yang memenuhi syarat, kesalahan dalam memperkirakan biaya dan waktu pelaksanaan.

**Kata kunci**: Manajemen Risiko, Gedung, Identifikasi Risiko, Dampak, Respon Risiko

***ABSTRACT***

*The project of building construction is one of the projects which has a high risk in its implementation based on the workload and also the height of the building structure. Implementation of this project requires a long time with a high level of complexity that causes uncertainty in the field and results in various kinds of risks in its implementation. Risk management should apply at the initial phase for project development, risk management will be very useful in developing an understanding of project uncertainty. It is highly substantial to understand the risk management concept before understanding the risks in industry of building construction. This study aims to obtain the dominant most influential risk factors in a project of building construction by applying Relative Important Index (RII) Method. The RII method is used to look at the greatest risk factors. Primary data of the research were obtained by filling the risk factor questionnaire by 32 respondents with the positions of Consultans, Chief Expert, Project Manager, and Site Manager. The results showed that The events included in the high risk category are as follows; lack of detailed drawings, a change in design, the designs and drawings do not comply with the bill of quantity, the amount of labor is changing, lack of availability of workers, lack of control and coordination in the field, additional scope of work, inaccuracy and mismatch of detailed*

*specifications on the design, lack of worker expertise and lack of qualified staff, error estimating costs and implementation time.*

***Keywords**: Risk Management, Building, Risk Identification, Impact, Risk Response*

## 1. Introduction

The project of building construction is one of the projects which has a high risk in its implementation based on the weight of the work and also the height of the building. Implementation of this project requires a long time with a high level of complexity that causes uncertainty in the field and results in farraginous kinds of risks in its enforcement. Compared to other sectors, construction projects are in the top position in the annual failure rate and outcoming liabilities[1]. Forese stated that the sector is delineated by having many participants of multiple disciplines who are involved together at heterogeneous stages throughout a single project. This characteristic adds more intricacy to the whole construction process which is a collection of time-consuming ventures[2]. Risk is elucidated as the multiplication of a loss / gain or the probability of a loss / gain and its several magnitude. The occasion is said to be totally uncertain if the probability of the occasion is 0% or very certain if the probability of the occasion is 100%. Between these two extreme probabilities, the uncertainty varies rather greatly. At present, risks can be evaluated taking various kinds of information[3].

Planning of risk management is the procedure of determining how to meet and organize the risk events for respective projects. Risk management should apply at the initial phase for project development; Risk management will be very useful in developing an understanding of project uncertainty. It is highly crutial to conceive the risk management concept before comprehending the risks in building construction project. In every phase of the projects there are many dimensions of the risks and uncertainties. The project major objectives are most often concerned to cost, time, function and quality as well as client contentment. Risk can be explained in various ways relying on the risk management focus, different relations between the objectives and the research scope[4]. The following should be considered: the risk importance, their actual management techniques, the existing status of risk management systems in the organisations, and barriers to effective management of risk from major stakeholders perspective. The research shows that economic and financial factor, followed by quality, are the most essential risks, and the industry commonly tries to elude or switchover these risks[5].

This study shows overall ranking of the risk factors occurs in the building construction field and response was given by the consultans, chief experts, project manager and site manager respectively. After discussion of rankings the recommendations for stakeholders has been discussed and future scope has been made.

## 2. Literature Review

Risk management in a project contains the management of risk, identification, analysis, planning of response, implementation of response, and project risk monitoring. Upgrading the likelihood and/or impact of positive risks and to downgrading the likelihood and/or impact of negative risks is the aims of the risk management in a project, with an eye to optimize the project success occasions[6].

### 2.1 Risk Management Planning

This process is elucidating how to conduct risk management activities for a project. The main advantage of this process is that it ascertains

that the type, degree, and visibility of risk management are comparable to both risks and the project importance to the organization and other stakeholders. This process is undertaked once in the project[7].

2.2 Identify of Risk
This process is to identify risks to the project as well as their sources, and document the characteristics of all project risks. The existing individual project risks documentations and overall project risk sources are the main advantage of this process. It also unifies together information. However, the project stakeholder can counter befittingly to recognized risks[8].

2.3 Analysis of Qualitative Risk
This process is selecting the risks of each project for further analysis and action by evaluating the likelihood of the risk occurring and its impacts as well as other characteristics. The major benefit of this process is it allows the team to focus more on risk with high priority[9].

2.4 Analysis of Quantitative Risk
This process is to numerically analyze the impact of a combination of risk factors and also the severity of the overall project objectives. The main benefit of this process is that it measures the impact of the overall project risk, and can also provide additional quantitative risk information to support planning to respond to the risk[10].

2.5 Plan Risk Responses
This process is to develop options, pick strategies, and approve on actions to meet overall project risk exposure, as well as to manage individual project risks. The major advantage of this process is that it acquaints convenient ways to tackle overall project risk and individual project risks. This process also gives resources and incorporates activities into project documents and plan of project management as demanded. This process is organized throughout the project[11].

2.6 Risk Response Implementation
Risk response implementation is the process of implementing an agreed project risk response plan. The main advantage of this process is it confirms that agreed-upon risk responses are implemented as planned in order to meet overall project risk exposure, reduce individual project impendences, and maximize individual project chances[12].

2.7 Risk Monitoring
The risk monitoring process is one of the most important processes, this is the process of monitoring the implementation of agreed risk response plans, tracking identified-risks, admiting and elaborating new risks, and evaluating how effective the risk monitoring process is throughout the project. The main benefit of this process is as a basis for decision making on a project based on actual information about overall project risk exposure and individual project risk[13].

## 3. Research Methodology

Research methodology is a scientific process that is commonly used in research or ways to gain data which will be taked for the purpose of the research. In methodology, it attempts to discover the questions given in systematic ways that are used and attempt to find out all the answers until it can draw conclusions[14].

3.1 Questionaire Design
This study inclusived search of literature and interviews. Literature review can be obtained through journals, books, proceedings, and websites. Based on the literature review that has been conducted, in this study obtained 50 dominant risk factors for building construction projects in Jakarta. Furthermore, these factors are categorized into seven groups such as: force major, logistics, manpower, contractual, design, implementation, and management. Content validity was conducted by five experts to evaluate the questionnaire-content validity, to examine readability, to verify whether these factors are in line with current conditions, and experts are also enabled to provide their opinions if needed.

3.2 Data Analysis Method
Questionnaire survey among owners, contractors, and consultans will be analysed applying Relative Importance Index (RII).

3.3 Measurement Scale

The measurement scale applyed in this research uses an ordinal scale. Ordinal scale is a standard scale used in research to distinguish data, as well as containing elements of ranking (degree), degree (degree) or level (level) through certain assessments. Assessments made can contain elements of objectivity or subjectivity or a combination of both.

**Table 1**. Ordinal Scale Used for Measuring of the level of Effect[14]

| Scale | Item |
|---|---|
| 1 | No Effect |
| 2 | Low Effect |
| 3 | Medium |
| 4 | High Effect |
| 5 | Critical Effect |

*Source : Sugiyono, 2012*

For analysing data by ordinal scale, each factor used Relative Importance Index (RII) by the following equation:

$$RII = \frac{5n1+4n2+3n3+2n2+n1}{5\,(n1+n2+n3+n4+n5)} \quad (1)$$

Where,

n1 = respondent's number who answered "Critical effect"

n2 = respondent's number who answered "High effect"

n3 = respondent's number who answered "Medium effect"

n4 = respondent's number who answered "Low effect"

n5 = respondent's number who answered "No effect"

3.4 Coefficient of Spearman's Rank Correlation

A correlation is simply defined as a relationship between two variables. In order to test the relative agreement/disagreement between the responses from different groups consultans, chief expers, project managers, site managers the ranks, derived from the ratings given by respondents corresponding to the risk factors predisposing in building construction project, are to be analysed using the Coefficient of Spearman's rank correlation.

$$R = 1 - \frac{6\sum d^2}{n\,(n^2-1)} \quad (2)$$

Where,

d = difference between ranks

n = number of parameter being ranked

## 4. Data Analysis And Results

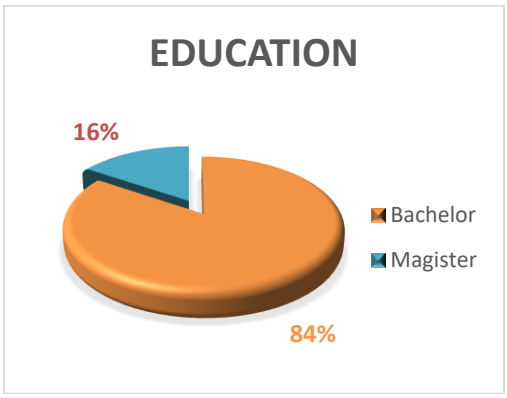
4.1 Stakeholder Details

Total 35 questionnaires were distributed to different respondents in Jakarta. Total 32 respondents provided their response for this research work. Table 3 shows the number of respondents.

**Table 2**. Respondent Profile

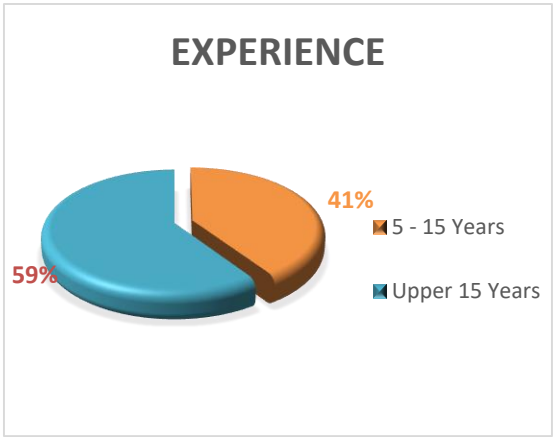
| No | Respondent | Total |
|---|---|---|
| 1 | Position | |
| | Consultant | 3 People |
| | Chief Expert | 5 People |
| | Project Manager | 19 People |
| | Site Manager | 5 People |
| 2 | Education | |
| | Bachelor | 27 People |
| | Magister | 5 People |
| 3 | Experience | |
| | 5 – 15 Years | 13 People |
| | Upper 15 Years | 19 People |

*Source: the Survey Results, 2018*




**Gambar 1**. *Pie Diagrams for the Education Category*
*Source: the Calculation Results, 2018*


**Gambar 2**. *Pie Diagrams for the Posistion Category*
*Source: the Calculation Results, 2018*




**Gambar 3**. *Pie Diagrams for the Experience Category*
*Source: the Calculation Results, 2018*

4.1 Data Analysis by Relative Important Index (RII) Method

The primary data accumulated from the questionnaire survey were analysed utilizing method of Relative Importance Index for ranking each factor from the perspective of consultans, chief expers, project managers, site managers. Table 3 shows the ranking of overall response by RII method for risk factors.

**Table 3**. Variable of Reseacrh

| No | Code | Variabel |
|---|---|---|
| | | **Force Majure** |
| 1 | A1 | Bad weather at the time of implementation |
| 5 | A2 | The wind is too strong at the project site |
| 6 | A3 | Earthquake |
| | | **Logistics** |
| 7 | B1 | Procurement of materials and equipment is unschedule |
| 8 | B2 | Equipment damage occurred during implementation |
| 9 | B3 | Late material order |
| 10 | B4 | Late delivery of material from the supplier |
| 11 | B5 | The volume of material sent is not suitable |
| 12 | B6 | Insufficient material availability |
| 14 | B8 | Increase in material prices |
| 15 | B9 | Damage or loss (theft) of material |
| 16 | B10 | Lack of equipment needed |
| 17 | B11 | Equipment that is not according to need |
| 18 | B12 | Storage of material in Logistics that is not recorded properly |
| | | **Manpower** |
| 19 | C1 | The amount of labor is changing |
| 20 | C2 | Lack of availability of workers |
| 21 | C3 | Lack of worker expertise and lack of qualified staff |

| | | |
|---|---|---|
| 22 | C4 | An accident occurred due to low security procedures |
| 23 | C5 | Lack of application of security and safety at work (K3) |
| 24 | C6 | Low labor productivity |
| | | **Contractual** |
| 25 | D1 | Incomplete documents |
| 26 | D2 | Non-current project funding |
| 27 | D3 | Termination of work unilaterally by the owner |
| 28 | D4 | Disputes between owners and contractors |
| | | **Implementation** |
| 29 | E1 | Congestion around the project site |
| 30 | E2 | Access to difficult locations |
| 31 | E3 | The construction method used is not appropriate |
| 32 | E4 | Damage that occurred in the surrounding area at the time of erection |
| 33 | E5 | Security disturbances at the project site |
| 34 | E6 | Incorrect steel fabrication and assembly |
| 35 | E7 | Quality of material that is not according to specifications |
| 36 | E8 | Changes in work schedule |
| 37 | E9 | The arrival of an undesirable NGO |
| 38 | E10 | Additional scope of work |
| | | **Design** |
| 39 | F1 | Design preparation and approval are late |
| 40 | F2 | Design error |
| 41 | F3 | The survey conducted at the time of design is not accurate |
| 42 | F4 | A change in design |
| 43 | F5 | Incorrect method of implementation |
| 44 | F6 | Incomplete data |
| 45 | F7 | The designs and drawings do not comply with the Bill of Quantity |
| 46 | F8 | Inaccuracy and mismatch of detailed specifications on the design |
| 47 | F9 | Lack of detailed drawings |
| | | **Management** |
| 48 | G1 | Error estimating costs and implementation time |
| 49 | G2 | Lack of control and coordination in the field |
| 50 | G3 | The material procurement process has stopped and has not been rescheduled |
| 51 | G4 | Poor coordination between stakeholders |
| 52 | G5 | Delay licensing before implementation |
| 53 | G6 | Implementation schedule that is not well planned |
| 54 | G7 | Administration that is not neatly recorded |

*Source: Study Literature, 2018*

**Table 4**. Ranking of Overall Response by RII Method for Risk Factors

| No | Kode | RII | Rank |
|---|---|---|---|
| 1 | A1 | 0.278 | 50 |
| 2 | A2 | 0.363 | 45 |
| 3 | A3 | 0.480 | 28 |
| 4 | B1 | 0.492 | 25 |
| 5 | B2 | 0.490 | 26 |
| 6 | B3 | 0.447 | 33 |
| 7 | B4 | 0.481 | 27 |
| 8 | B5 | 0.371 | 43 |
| 9 | B6 | 0.408 | 40 |
| 10 | B8 | 0.631 | 15 |
| 11 | B9 | 0.436 | 36 |

| | | | |
|---|---|---|---|
| 12 | B10 | 0.379 | 41 |
| 13 | B11 | 0.361 | 46 |
| 14 | B12 | 0.329 | 49 |
| **15** | **C1** | **0.767** | **4** |
| **16** | **C2** | **0.766** | **5** |
| **17** | **C3** | **0.742** | **9** |
| 18 | C4 | 0.453 | 32 |
| 19 | C5 | 0.455 | 31 |
| 20 | C6 | 0.526 | 20 |
| 21 | D1 | 0.426 | 38 |
| 22 | D2 | 0.611 | 16 |
| 23 | D3 | 0.682 | 23 |
| 24 | D4 | 0.587 | 17 |
| 25 | E1 | 0.500 | 23 |
| 26 | E2 | 0.337 | 48 |
| 27 | E3 | 0.440 | 34 |
| 28 | E4 | 0.419 | 39 |
| 29 | E5 | 0.361 | 47 |
| 30 | E6 | 0.365 | 44 |
| 31 | E7 | 0.471 | 29 |
| 32 | E8 | 0.637 | 14 |
| 33 | E9 | 0.437 | 35 |
| **34** | **E10** | **0.744** | **7** |
| 35 | F1 | 0.556 | 19 |
| 36 | F2 | 0.662 | 12 |
| 37 | F3 | 0.515 | 22 |
| **38** | **F4** | **0.804** | **2** |
| 39 | F5 | 0.561 | 18 |
| 40 | F6 | 0.653 | 13 |
| **41** | **F7** | **0.769** | **3** |
| **42** | **F8** | **0.744** | **8** |
| **43** | **F9** | **0.812** | **1** |
| **44** | **G1** | **0.689** | **10** |
| **45** | **G2** | **0.745** | **6** |
| 46 | G3 | 0.433 | 37 |
| 47 | G4 | 0.456 | 30 |
| 48 | G5 | 0.526 | 21 |
| 49 | G6 | 0.498 | 24 |
| 50 | G7 | 0.379 | 42 |

*Source: the Calculation Results, 2018*

The top ten factors of risk affecting in building construction projects with their level of effect as rated by considering all responses are listed below:

1. Lack of detailed drawings with a value of RII = 0.812
2. A change in design with a value of RII = 0.804
3. The designs and drawings do not comply with the bill of quantity with a value of RII = 0.769
4. The amount of labor is changing with a value of RII = 0.767
5. Lack of availability of workers with a value of RII = 0.766
6. Lack of control and coordination in the field with a value of RII = 0.745
7. Additional scope of work with a value of RII = 0.744
8. Inaccuracy and mismatch of detailed specifications on the design with a value of RII = 0.744
9. Lack of worker expertise and lack of qualified staff with a value of RII = 0.742
10. Error estimating costs and implementation time with a value of RII = 0.689

4.2 Coefficient of Spearman's Rank Correlation

The spearman's correlation coefficient was used to find out the correlation between the rankings given by consultans, chief expers, project managers, site managers. These correlation coefficient values show the amount of correlation between these stakeholders for ranking the risk factors affecting in building construction projects using RII method. Table 5 shows the spearman's correlation coefficient between stakeholders.

**Table 5**. Spearman's Correlation Coefficient between Stakeholders

| Groups | | Spearman's Correlation |
|---|---|---|
| Consultan | Chief Expert | 0.818 |
| Consultan | Project Manager | 0.891 |
| Consultan | Site Manager | 0.612 |
| Chief Expert | Project Manager | 0.745 |
| Chief Expert | Site Manager | 0.612 |
| Project Manager | Site Manager | 0.612 |

*Source: the Calculation Results, 2018*

## 5. Conclusions

This study is purposed to identify the risk factors predisposing in building construction projects. This research investigates all possible risk factors affecting in building construction projects through a structured questionnaire distributed in Jakarta. The survey outcomes are subjected to analysis, and the RII method is used to rank risk factors.

The events included in the high risk category are as follows; lack of detailed drawings, a change in design, the designs and drawings do not comply with the bill of quantity, the amount of labor is changing, lack of availability of workers, lack of control and coordination in the field, additional scope of work, inaccuracy and mismatch of detailed specifications on the design, lack of worker expertise and lack of qualified staff, error estimating costs and implementation time.

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