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Important Risk Identification on High-Rise School Building in Eastern Part of Indonesia

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Abstract: *Many high-rise school buildings have been built and operate all over Indonesia. This study is to identify risk determining variables and the risk assessment results of the high-rise school building developments in the Eastern part of Indonesia*
This study will use qualitative and quantitative research methods with repondence from the building owners. Factors and variable questioners were gathered from various journals and books. Questioner results were then analysed using SPSS version 22 program to get the determining variables over the reliable and optimum performance of high-rise school building projects in the eastern part of Indonesia.
Five dominant variables were identified in improving reliable and optimum performances of high-rise school building projects in the eastern part of Indonesia. They are on-site material schedule aligned with the project schedule, quick response time between signing of the agreement and site execution, good coordination between owner and contractor, low mobilization and demobilization costs, and on-site fabrication. The study recommends the owner to seriously observe the material schedule, coordination with contractors and mobilization to ease the construction process.

Keywords*: risk , construction , development, high-rise school building*

1. BACKGROUND STUDY

One of the government efforts to accelerate social welfare and eliminate poverty in the eastern part of Indonesia is through education by rigorously developing schools both done by the government or by private institutions. Most of the eastern part of Indonesia fall short of school buildings, which is why there are numbers of high-rise school building developments being constructed at the moment. There are some problems arise on site during the process, thus obstruct the succefull of the development.
Project is a temporary process with a certain period of time, a certain allocation of resources and an intention to complete the tasks with a clear specific target. Uncertainty of condition and situation is one of the project risks which can create problems in project execution. In the construction projects, there are three parameters usually observe, namely cost, quality and time. Those three parameters determines the successful of a project as being an on-time, on budget and meet a standard project quality. One of the examples is, if the availability of material on site is not adequate, then it needs to be imported from other places. This means increase in cost and delivery time which in turn affecting the project completion. Lack of qualified manpower in a region needs additional cost to transport them from other region. Distribution cost of material becomes high due to air or sea frights to accelerate the delivery time to the project.
Project management is a process by managing, allocating and scheduling resources in the projct to achive the target. In the project management, good planning and controlling can not guarantee the project to achive the target. The possibility to miss the target creates the need to analyse, manage and find solutions of the overseeing risks.
Risk management is a process to analyse, minimize and to find solutions for the risks by minimizing impact. Therefore, risk analysis on high-rise school development is important to be done. By doing so, it is expected that the project is on time, on budget and meet a standard quality.
By examining the background above, this study will look at the following:

1. What are the risk determining variables at the high-rise school building developments in the eastern part of Indonesia?
2. What are the risk analysis results at the high-rise school building developments in the eastern part of Indonesia?

2. ACADEMIC REFERENCE

2.1 School Building

School Building needs to refer to the building codes of Multistorey Act (UU Bangunan Gedung) No 28, 2002 by meeting the functional requirements of comfort, safety, and health

considering that the damage on the school building can disturb and paralyse education process due to unavailable facilities.

2.2 Overview of Eastern part of Indonesia

Eastern part of Indonesia will become a priority in infrastructure development in Indonesia especially in 2017. Directorate General of Public Works and Public Housing has allocated 60 % of 2017 budget to manage provincial road in the Eastern Part of Indonesia, such as Kalimantan, Bali, Nusa Tenggara, Sulawesi, Maluku and Papua. With ease of transportation access, there will be many infrastructure developments in that regions one of which is School Buildings. Based on Central Agency of Statistic (Badan Pusat Statistik) regarding number of school in 2014, Eastern part of Indonesia has very small number of school buildings as to compare with other regions such as in Java. For example, number of school building in Papua 2,431, Maluku 1,739, Nusa Tenggara Timur 4,820 while West Java has 19,981 and Central Java has 19,362.

2.3 Role of Owner in Project Process

The owner is a person or an institution who owns the project or tasks to be done by other parties according to the agreements. The owner has a responsibility to provide the budget to fund the project. The role of the owner are: to provide budget for design and execution of a project, to administer the project, to assign the contractor to do the project, to acquire responsibility from the construction management consultant, to receive the project once completed from the contractors. The owner also has the capacity to issue the letter of agreement, to agree or disagree variations in the design, to receive a handover from the contractor and to breach the contract if contractor can not perform according to the agreement.

2.4 Project Funding

In a construction process, cost is the main factor since construction projects are normallyinvolving a large amount of investment that is vulnerable to failure. Thus, project cost needs to be managed properly to minimize cost overrun (Dipohusodo, 1996)

2.4.1 Project Cost

Project fund is cost needed to complete every task in a project. In general, the project cost can be devided into direct cost and indirect cost.

Direct cost is a cost of everything which inturn become a permanent component of a project (Soeharto, 1995). The direct cost comprises of cost directly connected during a construction phase or a certain project, such as: material costs, labour costs, equipment costs and subcontractor costs.

Indirect cost is an expense related to management fee, supervision fee and payment of material or service of project procurement that will not be part of a permanent product but needed in the construction process (Soeharto, 1995). The indirect cost comprises of overhead cost, contingencies, loss/profit and penalty/bonus.

In a certain situation, penalty/bonus can be see as indirect cost that influence overall costs (Pilcher, 1992). The direct and indirect costs form a project cost, hence it is important to monitor these costs during the estimation and controlling processes. The direct and indirect costs will change in accordance to the time and project progress. Although it can not be calculated by a certain equation, in general indirect cost increases in line with the duration of the project (Soeharto, 1995).

2.4.2 Cost Engineering

Cost engineering is one of engineering fields that apply scientific principle and technique with experiences and engineering judgements in estimating, controlling and economic engineering (Asiyanto, 2003). Cost Engineering can be divided into cost estimation and cost control.

The role of cost engineer is to estimate project cost and cost control according to the

Agreement. In a construction project especially in large projects, cost engineer plays an important role to prevent financial chaos resulting from weak estimation and/or cost control.

2.4.3 Cost Estimation

Cost estimation in principle is an effort to value or estimate based on analytical calculation and experiences. Estimation of project cost in principle is an effort in applying engineering concept based on tender documents, site conditions and contractor resources (Dipohusodo, 1996).

There are two types of project estimation which are Owner Estimation and Bidding Price from the contractors (Asiyanto, 2003). Owner estimation is calculated by a cost engineer to give guidance in a bidding process. Bid price is a cost estimation calculated by a contractor estimation engineer for a bidding process based on tender documents.

The contract cost is a cost that need to be provided by the owner, while to the contractor is a sum of money received to complete the project.

A good estimation depends on the availability of a complete information where the estimation process is being estimated. In general, there are three main information needed namely:

a. Project information and its complete subsections with design drawings and technical specifications. The overall document is used to calculate the volume of works and a construction method.

b. Information of the resources during the project initiation by contractor, ie manpower and other resources available.
c. Information of the material prices which normally known better by a successful contractor. Normally the contractor has had an up to date knowledge of current material price and manpower cost (Dipohusodo, 1996)

The choice of estimation methods depends on the quality of information available. The final estimation process of a construction cost is developed through four main steps, ie:

a. Preliminary estimation used during the briefing phase and is based on past similar project costs.
b. Detailed estimation prepared by a project management team prior to tendering process based on a more accurate quantity measured on the tender drawings and its associated costs of previous project documents.
c. Contract costs is a good estimation cost for the owner in a fixed price contract form, but less important in other forms of contract agreement.
d. Operational estimation, normally prepared by the contractor based on construction planning (Austen, 1994)

2.4.4 Cost Control

Cost control is one of important aspect in project management; to minimize cost (Natan, 1986). Cost Control needs to look at time factor since there is a close correlation between completion time and associated costs or its supporting activities.

The practical purpose of cost control is to minimize the costs. In general there are 2 cost control methods which are Unit of Production Concept and Trade Concept. The Unit of Production Concept provide a glimpse of why and where cost overrun are. This method provide ease of cost estimation but difficult to calculate real costs of every tasks. The Trade Concept gives picture of which parts/units will give problems in the future.

The usage of this concepts is based on the system believed by the company and the magnitude of the project. A large projects normally use the Unit of Production Concept while smaller projects use the Trade Concept.

2.5 RISK MANAGEMENT

Based on AS/NZS ISO 31000: 2009 replacing AS/NZS 4360: 2004 regarding risk management – Principle and Guidelines, there are 11 principles that need to be understood and applied in the risk management framework and process to make sure its effectiness.

Those are:

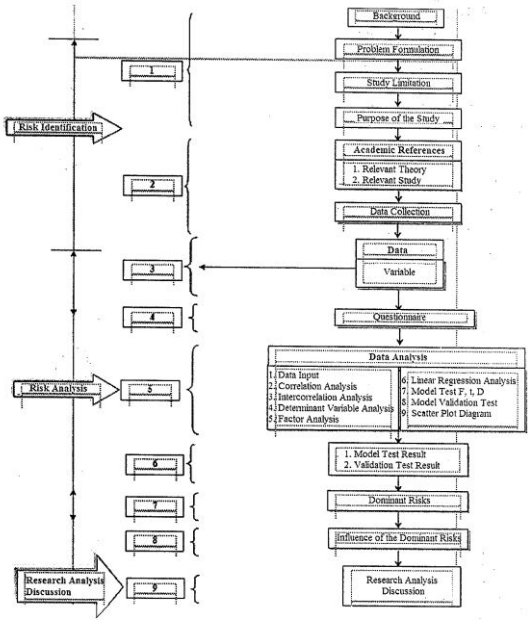
1. To give value added and protect the organizational values. This principle gives information that risk management activity must increase organizational capabilities in absorbing risks thus take the available opportunities and exist in the future. Hence, risk management must be able to anticipate negative risks endanger the organizational goals.
2. Integrated parts of overall organizational process. Risk management must attach to the overall organizational processes because every organizational process faces a risk resulting in failure to achieve target of the process. This principle implisitly stated that risk management is not only a responsibility of the top management but also to overall parts of the organization.
3. Decision making process. It must be reminded that every decision poses its risks. Therefore in every decision, organization must consider risks of each decision, availability of organization resources, and the capability and organizational leniency in absorbing the risks.
4. Specifically managing the uncertainty. Every organization faces uncertainty in the process of achieving the targets. Risk management reduces the uncertainty by providing parameters of risk consequences. These parameters show exposure of the organization to a particular risk which then decide on the risks handling. Risks handling is intended to help the organization in reducing the risks exposure and uncertainty.
5. Systematic, structured and on time. These principles stated that risk management must be run consistenly and integrally throughout the organizational structure. Formulation of risk governance that clarifies the capacity, role and responsibility of each unit in the organization in risk management is needed to support risk management effectiveness.
6. Based on the best available information. The risk management application must be supported by the organizational best available information. This information comprises of 3 aspects which are: relevancy, trusthworthiness, and on-time. The organization can document the process and form a database of information such as risk register. Without this information, risk management application can not achieve the target.
7. Based on organizational need. Every individual, task force, and organization owns its characteristic and faces direferent riks. One of the benefits of ISO 31000: 2009 is that it provides generic standard adoptable according to the need of risk assessors. Therefore, risk

assessors can not follow risk management system formed by the other unit or organization but has to adopt to the condition and risk faced.

8. Considering cultural and human factor. Risk management application must consider culture, perception, and human capabilities including calculating dispute of interest between organization and its individual. This is important to note because risk management application done by individual resource of the organization.
9. Tranparancy and inclusivity. Information and application of risk management must involve all parts of organization. The existence of risk can not be hid or exaggregated.
10. Dynamic, repetition, and responsive to the changes. This principle stated that the risk management must be implemented consistently and repetitively and must be able to facilitate changes internally and externally to the organization. Monitoring and reviewing processes become key activity in detecting the changes and facilitate the adjustment of risk management.
11. Facilitate sustainable correction and organizational improvement. The existence of risk management must be rectify from time to time according to the organizational internal and external development. A sustainable correction is expected to bring significant improvement to the organization.

3. METHODOLOGY OF THE STUDY

The initial stage of risk identification was to identify cause of risk factors in-term of cost of the high-rise school building developments in the eastern part of Indonesia to be able to be built. During this stage the cause of risk factors were collected from relevant research and theories. The identification results were then set in the form of questioners to collect opinion from the owner to find out whether there is impact of factors/variables found, to the optimum and reliable performance of the development. The questioiners were processed and analysed by correlation analysis and regression. Both analysis processes are done by SPSS program to facilitate the data processing.



Picture 1. Study Diagram

Variables analysed in this study are dependent and independent variables. The dependent variable (Y) is improving optimum and reliable performance of the high-rise school development in the eastern part of Indonesia. Indipendent Variable (X) in this study is started with 8 factors, ie: design evaluation, initial project estimation, unit price analysis, budget estimation, material cost, manpower cost, estimation cost and cost control. The 8 factors were then distributed into 50 independent variables. The respondents of the study came from the owner who had project in the eastern part of Indonesia, respondent who were based on the project such as a project manager. The respondent qualification minimum has a bachelor degree with 3 years experiences.

4. STUDY RESULT

Below is the analytical process diagram

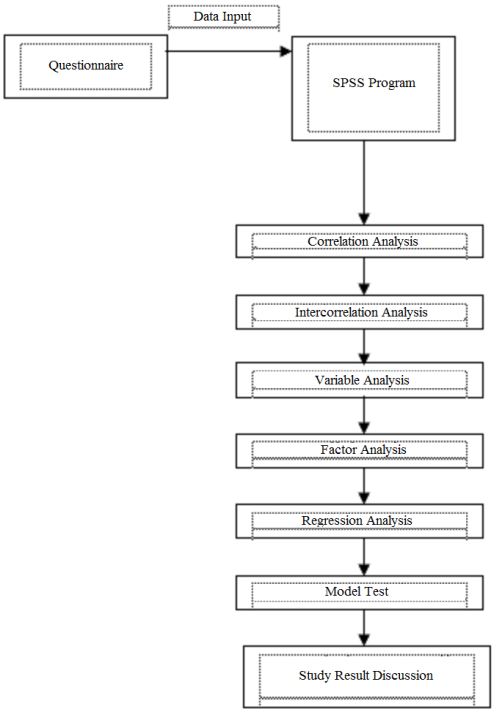


Exhibit 2. Analytical flow diagram and its discussion

X5	Design according to Standards & Regulations	.424**
X7	Fund available as planned	.827**
X11	Competent estimator	.827**
X13	Complete data and information	.824**
X17	Accurate cost estimation	.736**
X19	Clear and complete specification	.652**
X23	Ontime material schedule	.827**
X24	Good and correct material quality	.713**
X25	Material usage according to the specification	.402*
X29	On site fabrication	.482**
X30	Competent and sufficient manpower	.582**
X32	Manpower productivity as target and schedule	.779**
X34	Low mobilization and demolization costs	.681**
X39	Ontime material schedule	.745**
X44	Low frequency of design and construction changes	.589**
X45	Good workmanship, no re-work	.537**
X46	Number of projects at the same time	.478**
X47	Short duration between letter of agreement and construction	.699**
X48	Good coordination between owner and contractor	.632**
X49	Competent Project Management	.625**

Table 2. Correlation analysis result

Based on the correlation analysis resulta, there are 20 variables that have coefficient r ›0.4. These 20 variables were then be used to the next correlation analysis r‹0.4 to avoid influence from every variable. Based from these 20 interconnected variables, 10 variables has a coefficient of r‹0.4. These 10 variables were used to the next analysis.

Table 3. Intercorrelation analysis results

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin -Watson
1	.745[a]	.555	.544	.36481	
2	.856[b]	.732	.718	.28688	
3	.891[c]	.795	.777	.25481	
4	.906[d]	.820	.800	.24170	
5	.917[e]	.841	.818	.23047	1.604

a. Predictors: (Constant), X39
b. Predictors: (Constant), X39, X47
c. Predictors: (Constant), X39, X47, X48
d. Predictors: (Constant), X39, X47, X48, X34
e. Predictors: (Constant), X39, X47, X48, X34, X29
f. Dependent Variable: X51

NO	VARIABEL
X5	Design according to standards and regulations
X25	Material usage according to the specification
X29	On site fabrication
X34	Low mobilization and demolization costs
X39	Ontime material schedule
X44	Low frequency of design and construction changes
X45	Good workmanship, no re-work
X46	Number of projects at the same time
X47	Short duration between letter of agreement and construction
X48	Good coordination between owner and contractor

Table 4 Intercorrelation analysis results

Rotated Component Matrix

	Component		
	1	2	3
X46	.819	-.103	.077
X39	.764	.385	.034
X44	.748	.345	.036
X34	.682	.253	.239
X47	.534	.080	.492
X45	.154	.768	.201
X5	.053	.747	.231
X48	.397	.658	.087
X25	.090	.169	.846

X29	.092	.250	.837

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization. a. Rotation converged in 5 iterations.

Determination of which variables correlates to which factors is done by looking at the biggest correlation value. Table 4 shows the biggest value down to the smallest for every factor. The table shows that X46, X39, X 44, X34 and X47 fall into Factor 1, X45, X5, X48 fall into Factor 2 and X25, X29 Fall into factor 3.

Table 5. Model Analysis Result

Regression model was acquired from Table 5 above. The model can be described as follow:

Y = 0.893+0.375(X39)+0.256(X47)+0.288(X48)+0.153 (X34)+0.137(X29)

Where:
Y = optimum and reliable performance of high-rise school building developments in the eastern part of Indonesia
X39 = on time material schedule
X47 = short duration between signing of the agreement with the initial contruction process
X48 = good coordination between owner and contractors
X34 = low mobilization and de-mobilization costs
X29 = on-site fabrication

Contribution to the Y of significant variables from Table 5 is described as follows.

X39 = on time material schedule can contribute to the optimum and reliable performance of high-rise school building developments in the Eastern part of Indonesia with 55% contribution. Cost controlling hold the key to this dependant variable (Y). With a good planning and considering all aspects such as sea-freight distribution, weather, road condition, reliable transportation mode, material schedule can be on-time. Therefore, delay in material schedule can increase in the project cost since adding the construction time, overtime cost of manpower to catch up the delay, idle manpower costs, low product quality, and rework. Based on Project Management Body of Knowledge (PMBOK), life cycle of a project can be described as follows:

a. Phase I is a feasibility stage where a project is planned and then processed for a feasibility study, formulated the design strategy and acquired approval from the stakeholders. The feasibility of the project is determined in this phase
b. Phase II is the planning and design stage. Basic design, cost and schedule, contractual and planning documents are prepared in more detail.
c. Phase III is construction stage where material is prepared and sent to be construct by the contractor, installation is made and tested. In this final phase facilities constructed need to be finished and can be used properly.

X47 = short duration between signing of the agreement with the initial contruction process can contribute to the optimum and reliable performance of high-rise school building developments in the Eastern part of Indonesia with 17.7 % contribution. A tendering process normally occur in construction processes. The tendering process can be described in Figure 3.

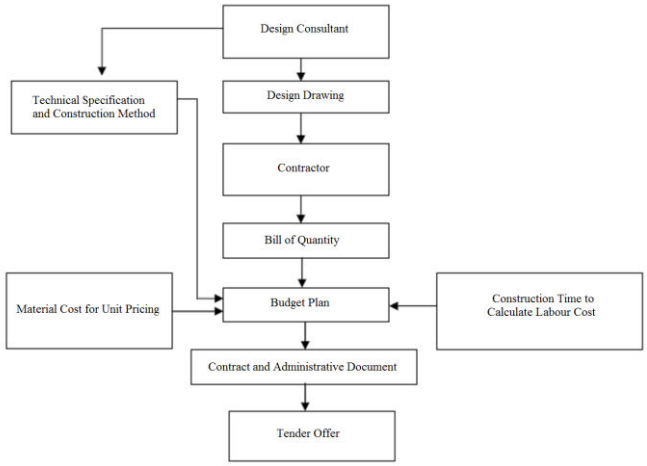


Figure 3. Tendering Phase

Figure 3 shows that the design consultants prepare design drawings, technical specifications and construction method to the contractors as a guidance to prepare a bidding document. The contractor will then calculate and prepare Bill of Quantity and Construction Budget Plan. Contractor will also include material costs and construction time together with the specified documents prepared by the consultants to calculate the unit price and Budget Plan. The Budget Plan together with administrative documents will form a bidding document. Tender process will then occur to get a shortlisted contractors. Negotiations and clarifications will then take place to award the

contract legalized by signing the contract agreement. Short duration between the signing of the contract and actual project start up indicates that the project is urged and must meet a certain deadline. This short duration can creates additional works, and inaccurate unit price. Hence, it will increase expenses beyond budget plan and may create loss to the owner or contractors.

X48 = A good coordination between owner and contractors can contribute to the optimum and reliable performance of high-rise school building developments in the Eastern part of Indonesia with 6.3 % contribution. Based on ISO 31000: 2009 regarding Risk Management, communication and consultation are important factors considering the 9th risk management principle demands inclusive and transparent risk management. This risk management must be done by all parts of organization and consider all stakeholders' interests. These communication and consultation can create adequate supports in risk management activities. It can also narrow the risk management activities to achieve the targets.

X34 = Mobilization and demobilization costs can contribute to the optimum and reliable performance of high-rise school building developments in the Eastern part of Indonesia with 2.5 % contribution. A reliable estimation depends on the availability of a complete information during the initial stage. In general, there are three main information cluster needed, namely:

a. Information regarding project and its parts completed with design drawings and specifications. This information is needed to calculate the volume of works and its contruction method.
b. Information regarding the resources, needed by the contractors to plan the execution, ie. Manpower and other resouces available in the region.
c. Information regarding the costs, which normally known better by a succeful contractor. Contractors normally have better knowledge of up to date material costs and other resources (Dipohusodo, 1996).

The selection of estimation method depends on the quality of the available information. Final construction cost estimation follows four main steps, ie:

a. Preliminary estimation used in the briefing stage and is based on previous similar project costs.
b. Detailed estimation, prepared by the project management team prior to tendering process based on a more accurate volume measured from the design drawings and costs from previous project documents.
c. Contract costs is a good estimation cost for the owner in a fixed price contract form, but less important in other forms of contract agreement.
d. Operational estimation, normally prepared by the contractor based on construction planning (Austen, 1994)

X29 = on-site fabrication can contribute to the optimum and reliable performance of high-rise school building developments in the Eastern part of Indonesia with 2.1 % contribution. On-site fabrication is expected to increase optimum and reliable performance of the project.

Five significant variables are acquired from questioners distributed from the contractors in regard to the optimum and reliable performance of high-rise school building developments in the Eastern part of Indonesia. Dominance variable result is influence by owner respondence with similar educational background and experiences. Homogenous respondences are expected to create better results in risk variables to improve optimum and reliable performance on high-rise school building developments in the Eastern part of Indonesia.

5. CONCLUSION

Having done the collection and analysis of data in this study, it can be concluded as follows:

1. Risk determining variables in the High-rise school building developments in the Eastern part of Indonesia are:
   X39 = on time material schedule
   X47 = short duration between signing of the agreement with the initial contruction process
   X48 = good coordination between owner and contractors
   X34 = low mobilization and de-mobilization costs
   X29 = on-site fabrication
2. Risk analysis results in the High-rise school building developments in the Eastern part of Indonesia are:
   X39 = on time material schedule can contribute to the optimum and reliable performance of high-rise school building

developments in the Eastern part of Indonesia with 55% contribution
X47 = short duration between signing of the agreement with the initial contruction process can contribute to the optimum and reliable performance of high-rise school building developments in the Eastern part of Indonesia with 17.7 % contribution
X48 = A good coordination between owner and contractors can contribute to the optimum and reliable performance of high-rise school building developments in the Eastern part of Indonesia with 6.3 % contribution
X34 = Mobilization and demobilization costs can contribute to the optimum and reliable performance of high-rise school building developments in the Eastern part of Indonesia with 2.5 % contribution
X29 = on-site fabrication can contribute to the optimum and reliable performance of high-rise school building developments in the Eastern part of Indonesia with 2.1 % contribution

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