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The Pilot Analysis of the Fire Safety Protection System Model on High Rise Buildings in DKI Jakarta

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Abstract*: Jakarta city risk category includes several risk factors, namely: the natural risk factors, social risk factors, risk factors artificial environment, and risk factors for future value. Fire danger risk factors included in an artificial environment. For the environment is still made up of forests and open green areas, the risk of fire is included in the nature of risk factors. In the context of an artificial environment, the city accommodate the load city consisting of several buildings (low, medium, high), urban infrastructure, urban landscape, mobility vehicles, the number of city dwellers are many and diverse. In the assessment perspectives Construction Management, as a fire hazard that can result in the risk of Jakarta could hinder implementation of Jakarta's sustainability process, which includes: planning Jakarta (existing and new), and the implementation of buildings in the city. This research will solve the problems of research which will focus on the study of the Master Plan for Fire Protection System State, namely: what factors are covers of the Master Plan for Fire Protection System in Jakarta, and any strategic recommendations to prevent the risk of fire in Jakarta and how the project pilot portrait analysis with respect to the Master Plan for Fire Protection System in Jakarta. This research has consisted of the research process: reviewing the issue portrait fires in Jakarta, analyzing portrait regulations and standards on fire risk in Jakarta, Jakarta reviewing organize strategies, and recommendations on the results of the analysis of the experts and the selected respondents.*
Keywords*: risk, fire safety, high rise buildings*

1. Research Background

The growth of the city continued to rise, one of which is marked with residential density and an increasing number of people from birth and urbanization. Its facilities and infrastructure, such as residential, office, industrial district, entertainment and other public facilities continue to increase. In addition to the positive impacts, the growth of the city also have negative impacts such as increasing the potential threat of fire hazard.

According to data from the Department of Fire and Disaster Management Jakarta, which was released on the web site, statistical fire data 2015 to May 2015 amounted to 435 events with distribution covering an area of West Jakarta (92 times), South Jakarta (87 times) and East Jakarta (89 times), North Jakarta (100 times), Jakarta (67 times). With the loss of many lives 13 people died and 30 were injured, and estimated material losses reached Rp.74.861.900.000. Residential buildings are burning objects which dominates in the housing, while the cause of fire is dominated by electrical short circuit, and also due to the stove, smoking, and others. These data also show that every day there are 3-4 cases of fires occurred in Jakarta.

The threat of fires in the city is becoming increasingly complex due to many densely populated, industrial buildings and high rise buildings that would require special handling in fire prevention and suppression efforts. Community participation is needed in prevention and mitigation of fire hazards in Jakarta. Without the participation of the community, the firefighters would have difficulty to carry out their duties and functions optimally. Duties and functions of the Department of Fire and Disaster Management Jakarta is doing prevention, suppression and saving lives and property from fire and other disasters.

2. Research Problem

Based on the background of the problems described above can be formulated research problems as follows:

a. What are the important things that need to be identified, studied and analyzed in the framework of Spatial Planning, Regulations & Standards and Regional Fire Management (RFM) in the Jakarta neighborhood?
b. What are the important things that need to be identified, studied and analyzed in the

implementation of the Risk Fire Safety Systems in Buildings and Environment area of Jakarta?

c. How portraits pilot project analysis in connection with the Master Plan for Fire Protection System in Jakarta?

3. Literature Review

Factually, the data indicate that many fires occurred in residential neighborhoods, especially in dense residential neighborhood. However, the facts also show that in neighborhoods equally dense it found a different phenomenon, where there are some dense residential neighborhood with a fire but also occurs in some dense residential neighborhood that rarely fires.[1]

Critical factors that determine the fire response performance are: the characteristics of the fire, people and buildings. Psychonomics seem to have a significant effect on the performance of the fire response.[2]

Evaluation of the reliability of the fire protection system in the building includes four components, namely: completeness footprint, rescue facilities, active protection systems, and passive protection systems. [3] Active fire protection systems are essential to minimize the loss of assets and life.

Location of firehouse that can efficiently give effect to the response time when the fire occurred. [4] Geographic Information System application allows to identify the best route in terms of travel distance, travel time, the slope of the road and the deceleration time when traveling from the post to the location of fire extinguishers. [5]

Internet of Things intelligence-based emergency fire response systems can reduce the victim to determine the point of disaster to prevent confusion in the emergency guide lights. [6] The system includes a response to the building fire-circuited between humans and computers on a large scale.[7]

Fire prevention systems and equipment must comply with the requirements of the standard are essential in order to ensure the safety of the building and its users. However, awareness of fire safety can certainly alleviate damage or mortality during a fire. Public awareness is closely related to the understanding of human behavior and their personal backgrounds.[8]

Develop a fire safety engineering design and validate the performance-based fire safety strategy that protects people, property and the environment from the effects of fire. [9] Use of the building automation system devices are new, have an impact on reaction time for the emergency fire decreased by 63%. [10]

The main components are dominant to anticipate the danger of fire is the application of Fire Safety Management; Training system / training; Inspection, data collection and testing of protection; Procedures and means of rescue; Fire safety housekeeping; Early notification to the occupant.[11]

The time needed to respond to emergencies more quickly when compared with the national standard response time [12], there is a difference between the current fire safety of buildings with fire safety in green building design [13]. Fire Risk Management Application to take appropriate measures in buildings based cluster scenarios to minimize the risk of fire.[14]

Reconfiguration of the fire and rescue services to improve the process and implementation of fire and rescue services.[15]

3.1. Guidelines and Standards Safety and Environment Building on Fire Risk

The current development, many legal products ranging from Law, government regulation, Minister Regulation, regional regulation, Regulation of the Governor to the Indonesian national standard which deals with the risk of fire and building safety and the environment. With the existence of this legal product would be expected to be used by all relevant stakeholders so that the building and the safe and secure environment.

The mindset of the investigation, as in Figure 1. explain how the relationship between the Master Plan for Fire Protection System with Spatial, Detailed Spatial Plan and the Regional Fire Management.

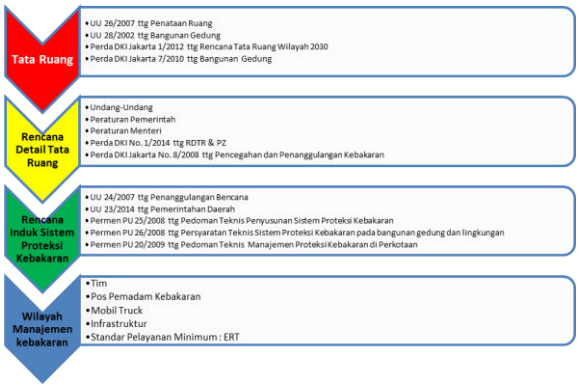

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Figure 1. Mindset Research

3.2. System of Building and Environmental Safety against Fire Hazard

The technical requirements include building safety reliability requirements for safety, health, comfort, convenience and special functions. The building should meet the requirements of building capability to support the load, as well as the ability of the building to prevent and counter the danger of fire and danger of lightning

3.3. *Fire Safety Management*

Fire Safety Management is a total frame of human security against fire. In an effort to improve the quality of security is then in a city should be formed Regional Fire Management (RFM) formed by grouping occupancy that have similar needs fire protection within a particular area, equipped with an alarm system in order to notice the fire that is integrated in the RFM and determined the response time from the nearest fire station. Based on these things then RFM service area is determined by response time should not be more than 15 minutes with a service area radius of no more than 7.25 km per RFM

4. Research Methodology

In this study, the method used is a survey method which is divided into two (2) sections, namely: data collected through questionnaires and interview, where the questionnaire was conducted using questionnaires designed specifically with the expectations of respondents answered all questions easily, and accurately so that the results obtained in accordance with the results of research and interviews were conducted with personnel who have the authority in decision-making in the company / institution he leads with the aim of validating the answers to the questionnaire or answer the questionnaire can also be done directly with a special interview.

4.1. Research Process

In doing this study, researchers set up a process of research conducted with the aim that this study can be carried out effectively and efficiently and generate relevant output. In this study using two types of variables, the dependent variable or Y is the performance of prevention, mitigation and control of fires in Jakarta, and the independent variables or the variable X is a master plan for fire protection system based on factors the risk of fire in Jakarta.

4.2. Data Collection and Research Respondents

In this study, there are two types of data, namely primary and secondary data. Primary data is the type of data collected by the researchers, for example such as interviews, questionnaires and data collection from others. Meanwhile, secondary data so obtained is based on a reliable reference, such as journals, archives of previous research and data. Broadly speaking, the collection of data in this study can be grouped into two stages, namely:

4.2.1. Data Collection Stage 1 - Validation Construct and Content Strategist

In the first phase of the data collection will be verified, clarification, and validation at least 5 experts on the variables that are used for identification of the risk of fire which had previously been collected based on previous research. It aims to reduce the fire risk variables that are less relevant, or you can add a variable that has not been listed. To collect the data at this stage, will use the questionnaire.

4.2.2. Data Collection Phase 2 - Pilot Survey

The variables that have been verified, clarification and validation by experts, subsequently used as a research variables. The variable will be variable pilot questionnaire survey is data collection stage 2. At this stage, it has been discussed about the understanding of 15 respondents to the questionnaire to be given. It aims to ensure that a good enough understanding of respondents in answering the questions, so that the data obtained valid.

5. Research Findings

In conducting this research, the method of analysis is based on risk management. Wherein, the analysis process is intended as an evaluation of the system of fire prevention and suppression. The following stages of planning methods of analysis with a risk management approach that will do:

5.1. Data Analysis Phase 1

The results of risk identification from the literature, there are 252 variables were identified which consists of 36 risk variables of the system of fire safety based spatial aspects that can improve spatial planning in the prevention, reduction and control of fire hazards in the area of Jakarta, 32 variable risk of system fire safety based on aspects of the area fire management which may affect the ability of area fire management in the prevention, reduction and control of fire hazards in the area of Jakarta, 155 risk variables of the system of fire safety by prevention aspect that can affect aspects of fire prevention in buildings tall buildings DKI Jakarta, 22 variable risk of fire safety systems based on aspects of prevention, and 7 variable risk of fire safety systems based on the aspect of control.

The results of the expert validation this early stage, the response is related to the variable correction that has been collected before. The answers from experts can be seen in Figure 2 below. The results of the validation of the variables related to construct and generate content by experts to 252 variables that can be continued to be made questionnaire as a pilot phase 2 of the project.

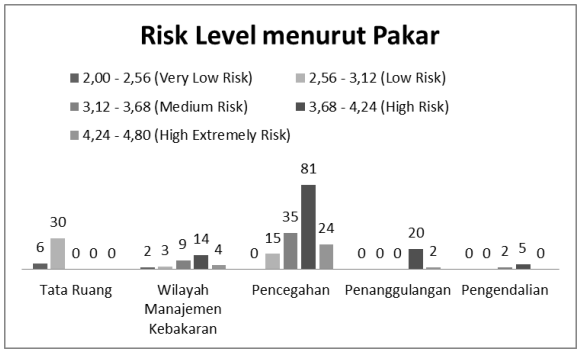

Figure 2. Risk Level by Expert

There are 8 variables (3.17%) in the category of very low risk, 48 variables (19.05%) fall into the category of low risk, 46 variables (18.25%) fall into the category of medium risk, variable 120 (47.62 %) fall into the category of high risk, and 30 variables (11.90%) in the category of extremely high risk.

5.2. Data Analysis Phase 2

Analysis conducted in phase 2 of this study is in the form of descriptive analysis. This analysis is used to evaluate understanding of the questionnaire given to potential respondents. The results of this analysis is a form of improved exposure questionnaire to be more easily understood by the respondents, descriptive analysis is carried out to provide an overview of the data that has been obtained.

Tabel 1. Descriptive Statistics

Descriptive Statistics

	N	Range	Minimum	Maximum	Mean	Std. Deviation	Variance
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic
X197	15	3.00	2.00	5.00	3.7333	.79881	.638
X209	15	4.00	1.00	5.00	3.9333	1.27988	1.638
Valid N (listwise)	15						

	N	Range	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
X197	15	3.00	-.415	.580	.380	1.121
X209	15	4.00	-1.746	.580	2.560	1.121
Valid N (listwise)	15					

Description of the variables are variables that are presented in the category of extremely high risk according to experts. Description of respondents to the variable X 197 (every household not go directly to the street or open space) is minimum 2, maximum 5, the mean 3.733, 0.79881 standard deviation and variance = 0.638, range = 3, skewness worth negative = - 0.415, and kurtosis is positive = 0.380.

Description of respondents to the variable X 209 (a source of electrical power to lift unplanned fires from two sources) is the minimum 2, maximum 5, the mean (mean) 3.933, 1.27988 standard deviation and variance = 1.638, range (range) = 4, skewed (skewness) worth negative = - 1.746, and kurtosis (kurtosis) is positive = 2.560. Y1 = spatial performance.

Tabel 2. Model Summary X-Y1

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.542[a]	.293	.239	.92086	2.080

a. Predictors: (Constant), X5
b. Dependent Variable: Y1

R square value of table 2 "model summary" showed that only 29.3% of the variable "spatial planning system has a very important priority in order to optimize the building and the environment" can be explained by risk prevention in the utilization of spatial economy in the prevention, mitigation and controlling fire hazard.

The value of the Durbin-Watson statistic test = 2.080, so it can be assumed that there is no auto correlation

Tabel 3. Model Summary X-Y2

Model Summary[c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.712[a]	.506	.468	.51314	
2	.815[b]	.664	.608	.44082	1.739

a. Predictors: (Constant), X12
b. Predictors: (Constant), X12, X196
c. Dependent Variable: Y2

R square value of table 3 "model summary" showed that only 66.4% of the variable "The importance of fire management area system in the process of building and environment" can be explained by "natural environmental risks in the planning of spatial use in the prevention, mitigation, and controlling fire hazard "and" absence of ventilation or smoke suckers on the emergency staircase affect aspects of fire prevention in buildings tall buildings ". Y2 = performance area fire management.

The value of the Durbin-Watson statistic test = 1.739, so it can be assumed that no auto correlation.

Tabel 4. Model Summary X-Y3

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.769[a]	.591	.560	.70060	1.654

a. Predictors: (Constant), X3
b. Dependent Variable: Y3

R square value of table 4 "model summary" showed that 59.1% of the variable "The importance of prevention systems of buildings and environments considered and implemented through the implementation of the safety system of the building against fire" can be explained by the "culture of risk

prevention in the system of spatial planning in preventive medicine, prevention, and control of fire hazards. ". Y3 = Performance Planning.

The value of the Durbin-Watson statistic test = 1.654, so it can be assumed that there is no auto correlation

Tabel 5. Model Summary X-Y4

Model Summary[f]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.597[a]	.357	.307	.69404	
2	.818[b]	.670	.615	.51754	
3	.883[c]	.780	.719	.44161	
4	.924[d]	.853	.795	.37783	
5	.957[e]	.916	.870	.30111	2.126

a. Predictors: (Constant), X3
b. Predictors: (Constant), X3, X12
c. Predictors: (Constant), X3, X12, X15
d. Predictors: (Constant), X3, X12, X15, X223
e. Predictors: (Constant), X3, X12, X15, X223, X207
f. Dependent Variable: Y4

R square value of table 5 "model summary" showed that 91.6% of the variable "The importance of building systems and environmental countermeasures considered and implemented through the implementation of the safety system of the building against fire" can be explained by:

a. Culture of risk prevention in the system of spatial planning in the prevention, mitigation, and control of fire hazards. (X3)
b. The natural environment of risk prevention in the planning of spatial use in the prevention, mitigation, and control of fire hazards. (X12)
c. Culture of risk prevention in the system of spatial planning in the area of prevention, mitigation, and control of fire hazards. (X15)
d. Risk prevention by providing information through brochures, leaflets and posters in large sizes and installed at strategic places to remind the occupants / users of the building will be a fire hazard. (X223)
e. Risk prevention against the risk of fire lifts error that can't be stopped at each floor. (X207)
f. Y4 represents the performance of the response variable.

The value of the Durbin-Watson statistic test = 2.126, so it can be assumed that no auto correlation.

Tabel 6. Model Summary X-Y5

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.731[a]	.534	.498	.75107	2.318

a. Predictors: (Constant), X3
b. Dependent Variable: Y5

R square value of table 5 "model summary" showed that 49.8% of the variable "The importance of building control systems and environments considered and implemented through the implementation of the safety system of the building against fire" can be explained by the "culture of risk prevention in the system of spatial planning in preventive medicine, prevention, and control of fire hazards. ". Y5 is a variable control performance.

The value of the Durbin-Watson statistic test = 2.318, so it can be assumed that there is no auto correlation

6. Conclusion

At the end of the study phase 1 and phase 2 recommendations about variables, indicators and parameters are very necessary attention in order to realize the city of Jakarta which is safe, healthy, comfortable, easy is the ranking value R square of the highest value is variable countermeasures, area fire management, prevention, control and spatial.

Variables that dominate in the model obtained in models of prevention are:

- Culture of risk prevention in the system of spatial planning.
- The natural environment of risk prevention in the planning of spatial use.
- Culture of risk prevention in the system of regional spatial planning.
- Risk prevention by providing information through brochures, leaflets and posters in large sizes and installed at strategic places.
- Risk prevention against the risk of fire lifts error that can't be stopped at each floor.

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