FACTORS INFLUENCING SAFETY AND HEALTH PERFORMANCE FOR LOW COST HOUSING: DEVELOPER'S PERSPECTIVE

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ABSTRACT

Sustainable building and construction practices in Indonesia aim to improve the safety and health performance of buildings which influence on resources and the natural environment. The objective of this study is to investigate the degree of importance factors of safety and health performance for low cost housing from developer's perspective and provides recommendation on strategies to tackle these issues. Data collection was done through survey to developers which have housing projects in Jakarta. Interview to key person in the construction industry were done by using structured questionnaires. The results indicate that (1) Architecture; (2) Building Services; (3) External Environment; (4) Operational and Maintenance; and (5) Management Approach are the importance of safety and health performance for low cost housing. This paper contributes towards better understanding on developers' view on how the safety and health performance are determined and form a basis for government to help tackle awareness of building safety and health issue.

KEY WORDS

Housing developers, low cost housing, sustainable building, construction, safety, health.

The term sustainable building and construction addresses the economic, ecological, and social issues of an infrastructure in the context of its community. The principles of sustainable building construction are carry out the idea of Principle 15 of the Declaration of the United Nations Conference on the Human Environment: 'Planning must be applied to human settlements and urbanization with a view to avoid adverse effects on the environment and obtaining maximum social, economic and environmental benefits for all'. Another source defines sustainable building and construction as: 'That which effectively integrates low energy design with materials, which have minimal environmental or ecological impact (in manufacture, use and disposal) whilst maintaining social diversity'. From these definitions, sustainable building and construction is applicable across the entire life cycle of constructions, from planning to disposal, depending on the conditions where it is implemented. The principles of sustainable building and construction should apply when evaluating the components and other resources needed for construction. When considering the resources needed to create and operate the built environment during its entire life cycle: land, materials, water, energy, and ecosystems.

In Indonesia, the agenda for sustainable building and construction had been launched by The Indonesian Ministry of Public Works. This agenda was called a draft of Agenda 21 for Sustainable Construction in Indonesia and was developed based on the document of the Agenda 21 for Sustainable Construction in Developing Countries with the national conditions in mind [1]. It was derived to achieve the three enablers, i.e., technology, institution, and value system enablers. While the government has set an initial and necessary initiatives in implementing sustainable construction in Indonesia, the practitioners has also been beginning to consider sustainable practices [2].

Sustainability building and construction has a complex relationship with the quality of housing and it has huge impacts on the economic, social and environmental dimensions of sustainable development [1]. As the country aspires to become a developed nation, there is a need for a sustainable strategy for housing development in Indonesia, especially in the national housing policy. Through 13th economic policy package that has been released, the

government's "1 million houses program" (a five-year program) should get a real boost. This program is one of the strategies to alleviate the nation's housing backlog from 11.4 million houses at the start of 2016 to (a targeted) 6.9 million by 2019. Considering that it will be less expensive for developers to build low-cost housing projects, end-consumers should also be able to purchase the house for a lower price. Indonesian in all levels has accessibility to adequate, affordable and quality shelter [3].

In Jakarta, after the New Order government started in the late 1990s, some advances in the authority of housing affairs occurred. The Jakarta administration plans to build 6,000 new low-cost apartments this year. In addition to helping low-income buyers finance their mortgages, the government is engaged in the construction of low-cost apartments, or *rusunawa*, itself. The government has plan at least 200 low-cost residential towers per year over a five-year period, partly to provide accommodation for residents moved out of riverbank slums as the capital tackles congestion and flooding.

However, as low-cost housing remains to be seen primarily as a government's responsibility and a loss-making venture, it is unlikely for developers to consider quality and performance in their low-cost housing projects [3]. Indeed, studies like [4] have recognized factors that impede the implementation of sustainable practices. They are a lack of legislation and enforcement; a lack of knowledge and awareness; and a passive industry culture. These factors in turn lead to other problems such as dilapidation, poor provision of services, bad location and others [3].

In response to the issues highlighted above, this paper will fill in the gap by examining factors that are contributing to safety and health performance of low-cost housing in Indonesia from developer's perspective.

LITERATURE REVIEW

Low cost housing Provisions in Indonesia. In Indonesia, the government has an important social responsibility towards housing provision for the people. As been specified in Indonesian Republic Act no 20/2011, the government concern to low-cost housing. The objective of low-cost housing development program is to fulfill the social and economic needs through affordable and adequate settlement especially for low-income group (article 3). Indonesian Housing Minister Regulation no 14/2007 has concern about low-cost housing management that includes some aspects (article 3), such as facilities (Education, health, praying and sport facilities), infrastructure (road, stairs, corridor, drainage, waste water treatment, waste system and clean water) and utility (electrical, gas and telephone network, and fire extinguisher) (article 4).

The specific purpose of low-cost housing in Indonesia is to improve the living quality of the low-income population. The impact of residential settings on human safety and health is therefore crucial. Therefore, the research was designed to provide standard safety and health performance model to a new or existing building conditions, whilst a wider scope of aspects about building safety and health, including building design, existing conditions, and management practices, were taken into account in this study.

Building safety and health factors. One of performance criteria for buildings is the performance in safety and health, which is the focal point of this study. Constitution of the World Health Organization (WHO) defines health as "a state of complete physical, mental, and social well-being, not merely the absence of disease". This health concept is significant in measuring building health quality, encompassing a complete state of physical, mental, and social well-being. The definition of a healthy building, based on the relevant literature, can be summarized as one that protects occupants from hazardous materials, building-related physical and mental illnesses, physical injury and death during its entire life cycle [5].

On the other hand, it has been pointed out that design aspects of a building is usually hard to change technically or economically, whereas management is dynamic to changes according to the current needs [28]. A more elaborate definition, they defined them as "built environment that safeguards its occupants and the general public as a whole from physical,

psychological, or material harms originating from the built environment, aims to reduce injuries and deaths, and hence, encourages the positive well-being of humanity”.

On the property prices of the buildings, they also pointed out that the safer properties generally commanded higher market prices. It is clear that the value of buildings form the basis for adopting a different approach in the design and management process. The safety and health of building has invaluable significance which must be retained maximally. It is clear that housing condition is an important issue in all over the world to enhance safety, health and sustainability of built environment.

A safe building is one that protects occupants and also the public from death and physical injury”[4]. It has been suggested that an establishment of building assessment schemes in recognizing the prominence of design and management [7]. It would help all groups in the life-cycle of buildings to better understand and apply the principles of safe design as an integral part of management processes. Several others researchers have conducted survey in different areas of the world contributing to identify the safety and health building performance factors (Table 1).

Table 1 – Building safety and health factors from previous studies

<i>Construct</i>	<i>Item</i>	<i>Parameters</i>
Architecture	X1	Means of Escape [8], [9], [10], [11], [12], [13]
	X2	Means of Access [6], [8], [9], [10], [11], [12]
	X3	Structural & Finishes Integrity [8], [13], [14], [15], [16], [17]
	X4	Building Material [13], [14], [15], [16]
	X5	Aminities [6], [10], [11], [16], [18], [19], [21]
	X6	Space Functionality [10], [11], [15], [16], [19], [21]
	X7	Fire Resistant Construction [6], [9], [10], [12], [16]
Building Service	X8	Electricity Supply [8], [9], [10], [13], [15], [16]
	X9	Lighting [5], [8], [9], [10], [15]
	X10	Ventilation [5], [8], [10], [13], [15]
	X11	Air Conditioning [8]
	X12	Plumbing [8], [9], [10], [14], [15], [16]
	X13	Sanitary Service [8], [9], [15], [16], [20]
	X14	Fire Service [9], [11]
	X15	Lifts [8], [14], [20]
External Environment	X16	Emergency Service [6]
	X17	External Hazards [15], [19]
	X18	Location [5], [10]
	X19	Air Quality [5], [10], [15], [18], [19]
	X20	Peaceful Environment [5], [10], [11], [19], [21]
	X21	Aesthetics [11], [15], [17], [18], [19]
Operational & Maintenance	X22	Building Peripherals [6]
	X23	Structural and Finishes Integrity [8], [6], [16], [17]
	X24	Building Service Condition [8], [9], [10], [16], [21], [22]
	X25	Transformation of Building [19], [22]
	X26	Fire Compartment Integrity [6], [9], [10], [16]
Management Approach	X27	Emergency Evacuation Plan [6], [9], [23]
	X28	Documentation & Evaluation [6], [16], [21], [22], [23]
	X29	Safety Education [8], [2]
	X30	Security Management [8], [23]
	X31	Occupant Safety Management [11], [19], [23]
	X32	Waste and Cleaning Service [10], [20], [22]

METHODS OF RESEARCH

This research employed a multistage data collection. The first stage involved literature review on concepts related to safety and health performance such as architecture, building services, external environment, operational & maintenance, and management approach. A questionnaire survey and interview questions was formulated based on the outcome of the literature review.

The second stage involved pilot study using the questionnaire with professionals in the

construction industry, including consultant, contractor, government regulator, land surveyor, trader, and client, to obtain their views on the proposed questions. Based from the pilot study, some of the questions were deleted within the allocated time of answering the questionnaire from 15 minutes to 20 minutes. Total 32 items were used to identify factors influencing the safety and health performance from developers' perspective.

Data collection was done through survey to 29 developers which have housing projects in Jakarta. The list of developers is obtained from Ministry of Public Works and Housing Indonesia, Indonesian Contractors Association (ICA), and The Association of Precast and Pre-stressed Concrete Companies.

The scope of samples has been limited to engineers, architects, building surveyors, quantity surveyors and developers as professionals in building construction. As the research focuses on design and management aspects of buildings, gathering research data and inputs from the professionals would be more appropriate and relevant.

The state of Jakarta is chosen for this research because it is one of the most active city in Indonesia in terms of housing development. At the same time, Jakarta is facing a critical issue on housing in relation to its safety and health performance. Total of 48 respondents from 29 developers' firms respond to the questionnaire. The next stage of this research involved the data analysis. The data were analyzed using descriptive analysis. Prior to the analysis, the main loading and cross loading of the items are checked to ensure the reliability of the indicators. The items that exceed the recommended value of 0.5 are retained.

The convergent validity of the measurements used in this research is obtained by examining the AVE. The variance shared with a construct and its measures is greater than the error when the AVE is greater than 0.50. The result shows that all the AVEs are above 0.50.

Respondents' background. The study managed to obtain questionnaires from 5 project managers (10%), 4 general managers (8%), 3 planners, 1 construction manager and 2 quantity surveyors. 33 people with other positions, such as owner, quality control, technician building facility, project engineer, site engineer, HSE coordinator, geotechnical supervisor, site supervision, and procurement.

Table 2 – Profile of Respondents (N = 48)

No	Variable	Description	Number of Respondent	%
1	Current Position	Project Manager	5	10
		General Manager	4	8
		Planner	3	6
		Construction manager	1	2
		Quantity Surveyor	2	4
		Others	33	69
2	Work Experience	0 - 5 years	25	52
		6 - 10 years	7	15
		11 - 15 years	10	21
		16 - 20 years	2	4
		20 - 25 years	4	8
3	Education	Diploma	10	21
		Strata 1	27	56
		Strata 2	6	13
		Others	5	10

Most of them (56%) have a bachelor's degree; 6 (13%) have a master's degree. Ten people (2%) graduated with a diploma, and five people (10%) graduated from high school.

In terms of work experience, 25 (52%) have worked experience less than five years. Seven respondents have work experience between 6 and 10 years. Ten respondents have work experience between 11 and 15 years. Only 2 (4%) and 4 (8%) respondents have work experience between 16 and 20 years and 20 and 25 years, respectively. Table 2 summarises the respondents' profiles.

Developers' background. Most of the developers are private limited companies (83%), and a few are government-linked companies (17%).

Table 3 – Profile of Developers (N = 29)

No	Variable	Description	Number of Respondent	%
1	Type of Ownership	Private Limited	24	83
		Government-linked Company	5	17
2	Company Establishment	0 - 5 years	7	24
		6 - 10 years	2	7
		11 - 20 years	2	7
		21 - 30 years	4	14
		> 30 years	14	48
3	Type Organization	Contractor	17	59
		Consultant	4	14
		Client	1	3
		Others	7	24
4	Business / Project Type	Industrial	2	7
		Housing	7	24
		Industrial and Residential	6	21
		Others	14	48
5	Business Scope	National	15	52
		International	14	48

In relation to company establishment, 2 developers have been established between 11 and 20 years, and an equal number of companies have been founded between 6 and 10 years. Fourteen companies have been operating for more than 30 years (48%). Seven companies have been operating less than 5 years. Only four companies (10%) have been operating between 21 – 30 years. Most of the developers operate within national scale (52%), whereas 48% are expanding to an international scale.

In relation to the projects result shows that seven of developers (24%) are involved with housing/residential. Only two developers focus in industrial projects, and six developers in mixed projects. Mixed projects refer to a combination of residential and commercial projects. The others are in surveying and mapping, interior contractor, government, logistics and digital currency. Table 3 summarizes the developers' profiles.

RESULTS AND DISCUSSION

In total there are 32 items related to the developers' view on determining the safety and health performance. These items are classified into architecture, building services, external environment, operational & maintenance, and management approach as independent variables. All items of the latent variables are evaluated using a five point Likert scale (1 - strongly disagree, 2 - disagree, 3 - neither agree nor disagree, 4 - agree, 5 - strongly agree).

Table 4 - Descriptive Analysis of The Safety and Health Performance Variables for Low Cost Housing from Developer's Perspective According to Ranking

Parameter	Min	Max	Mean	St.Dev
Architecture	1.00	5.00	3.65	0.06
Building Services	1.00	5.00	3.68	0.12
External Environment	1.00	5.00	3.69	0.04
Operational & Maintenance	1.00	5.00	3.61	0.05
Management Approach	1.00	5.00	3.58	0.05

The exact mean value of the five latent variables varies from 3.58 to 3.69 along with the standard deviation ranging 0.05 to 0.12 on a five-point Likert scale. Nevertheless, the mean values of all of the variables are above the 3.50 midpoint. External Environment obtains the highest mean value (3.68), whereas management approach has the smallest mean value (3.58). The distribution values documented via standard deviation shows that building services have the highest value (0.12), whereas operational & maintenance and management approach have the smallest value (0.05). The results suggest that external environment is the most important factor that influences safety and health performance based on the developers' perception, followed by building services factors, external

environment factors, operational & maintenance factors, and management approach factors. Table 4 provides the result acquired from the descriptive analysis according to the ranking.

The mean values of all of the variables are above the 3.0 midpoint. X14 scores the highest mean value (4.06), whereas X31 obtains the lowest mean value (3.06). The dispersion values reported through standard deviation indicates that all the dispersion values are less than 2. X8 has the highest dispersion value (1.14), whereas X14 has the lowest dispersion value (0.81). Table 5 lists the results obtained from the descriptive analysis

Table 5 – Descriptive Analysis of The Safety and Health Performance Sub Variables for Low Cost Housing from Developer's Perspective According to Ranking

Items	Min	Max	Mean	St.Dev
X1	2.00	5.00	3.73	1.04
X2	2.00	5.00	3.63	0.87
X3	1.00	5.00	3.42	0.90
X4	1.00	5.00	3.54	0.98
X5	1.00	5.00	3.63	0.91
X6	1.00	5.00	3.83	0.88
X7	1.00	5.00	3.77	0.92
X8	1.00	5.00	3.73	1.14
X9	1.00	5.00	3.27	0.87
X10	1.00	5.00	3.48	0.85
X11	1.00	5.00	3.71	0.97
X12	1.00	5.00	3.85	1.03
X13	1.00	5.00	3.48	0.81
X14	1.00	5.00	4.06	0.81
X15	1.00	5.00	3.83	0.92
X16	2.00	5.00	3.85	0.95
X17	2.00	5.00	3.83	0.93
X18	2.00	5.00	3.69	0.84
X19	1.00	5.00	3.06	0.94
X20	2.00	5.00	3.85	0.95
X21	2.00	5.00	3.83	0.93
X22	2.00	5.00	3.69	0.84
X23	1.00	5.00	3.06	0.94
X24	2.00	5.00	3.85	0.95
X25	2.00	5.00	3.83	0.93
X26	2.00	5.00	3.69	0.84
X27	1.00	5.00	3.06	0.94
X28	2.00	5.00	3.85	0.95
X29	2.00	5.00	3.83	0.93
X30	2.00	5.00	3.69	0.84
X31	1.00	5.00	3.06	0.94
X32	2.00	5.00	3.85	0.95

The most important factors of safety and health performance for low cost housing in Jakarta. The developer's perspective is that the external environment is the most important factor of safety and health performance for low cost housing. The results reveal that when the external environment of the project is equipped with proper emergency services, peaceful environment and aesthetics specifications, external environment can contribute to the safety and health performance.

CONCLUSION

Through the questionnaire survey the most important factor of safety and health performance for low cost housing in Jakarta have been validated. This paper captures a clear understanding of the important factors that determine the safety and health performance from the perspective of the developers. Based from the results, it is recommended that affordable housing projects develop need to consider external environment factors. The results and findings of this research contribute to a comprehensive

mechanism to enable policy makers to handle issues related to controlling the safety and health performance. The research has recognized that the small sample size is the most obvious limitation. It is recommended that future research should consider larger sample size for more generalize results.

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