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Criteria for Medium Segment Vertical Housing Selection: User Perspective

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Abstract: During this time, design of vertical housing in Jakarta is still lacking of attention to sustainable development aspects and focuses more on physical aspects and cost aspects. This can lead to sick building syndrome. In regard to sustainability construction aspects, the vertical housing design is not only considering cost but also health. This is the first stage of the study and aims to create a construct model developed using PLS-SEM, which consists of factors considered in the aspects of sustainable development. The second stage of the study will be developed after the filled-in questionnaire results are obtained and analyzed using PLS-SEM.

Keywords: Vertical housing, sick building syndrome, safety, health, sustainable development, PLS-SEM

1. Introduction

Sustainable development is the main priority of the construction industry in Indonesia. The quality of housing development has a large impact on three dimensions of sustainable development in order to achieve the objectives and balance simultaneously between the economic, social and environmental as well as its priorities. In reality the relationship between sustainable development and quality requirements for housing development is a complicated matter. The quality of the vertical housing development is a complex problem, which is related to the daily life of the community, such as housing demand that grows faster than housing supply. So, an appropriate strategy is needed, especially building safety and health problems and maintaining development of the vertical housing is concerned with environmental sustainability issues. Actually, the safety and health issues of vertical housings are major component of the comfort of individuals and communities that will occupy them, and this will contribute significantly to economic productivity and prosperity. In response to the issues highlighted above, this paper will examine selection criteria that are considered by users in the purchasing of vertical housing in Jakarta - Indonesia.

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 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 avoiding adverse effects on the environment and

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obtaining maximum social, economic and environmental benefits for all'. The IHBC (1998) also defines sustainable housing 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, depending on the conditions where it is implemented. According to Republic of Indonesia Act No.20 of 2011, the definition of flats, are 'high-rise buildings that are built in an environment, divided into functionally structured parts both horizontally and vertically, can be owned and used separately, especially for residential equipped with joint parts, joint objects, and shared soil'.

1.1 Building Safety and Health

As human beings who live in this rapidly changing world, on the one hand it is mandatory to adjust to its development, adjust to changes that occur, but also believe in one opinion that it is important to have the ability to plan developments and changes - changes in the future. Humans have the ability to direct future development and in the case of flats, diverting or adjusting the culture of living in a house with a large yard is a change in the culture of an agrarian society to a more suitable culture. After living in a crowded city, it is necessary to adjust the function of the house in addition to being a place to foster families, also taking into account the house as a functional means of living with family.

1.2 Problem Definition

The Indonesian Ministry of Public Works has launched a draft of Agenda 21 for Sustainable Construction in Indonesia as an initial and necessary initiative in implementing sustainable construction in Indonesia. The draft was developed based on Agenda 21 for Sustainable Construction in Developing Countries with the national conditions in mind.

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. As the country aspires to become a developed nation, there is a need to develop national housing policy which consists of sustainable strategy for housing development in Indonesia. Through 13th economic policy package that has been released, the government's "one million houses program" (a five-year program) is one of the strategies to alleviate the nation housing backlog. The gap that occurs between the number of houses needed and the number of available homes creates a backlog condition. In 2016 the Central Statistics Agency managed to collect housing backlog figures of 11.56 million units or 17.42% of the total national households. Furthermore, based on data compiled by the University of Indonesia Demographic Institute in 2017, as many as 20.5% of the 251 million Indonesian population do not have permanent housing.

The need for housing has become a continuing problem in big cities. This problem occurs because the rate of population growth caused by birth and urbanization is not comparable to the availability of land and housing facilities. Population density, limited land, and the conditions of large cities cause difficulties in realizing the community's need for comfortable housing. It can be interpreted that there are still approximately 50 million people who need decent housing. On the other hand, it is expected that end-consumers at all levels in Indonesia should have the accessibility to purchase an adequate, affordable and quality shelter.

The difficulty of overcoming the housing backlog figures raises concerns for the millennial generation to be able to have a decent residence. The size of this generation is quite large, reaching approximately 60% of the total population of Indonesia, which makes this millennial group a potential target for home and apartment developers. But the various schemes for home ownership loans offered are considered to be still not balanced with an increase in insignificant income, making it more difficult for the millennial generation to own a house.

Based on the Rumah123.com survey as of December 2016 it was known that 94% of millennials aged 23-37 years had a salary range below IDR 12 million. With this salary, it is common for a bank to determine the monthly payment of a housing loan not more than 30% of the salary or 3.6 million rupiah per month. Using 12% annual interest rate and 15 years credit period, the price of the house is IDR 430 million with 30% down payment. Whereas if the example is taken for the capital city, 95% of the property supply price is already above IDR 480 million rupiah.

Early in 2018 the government launched Liquidity Facility for Housing Funding (LCHF), which determined the price of the house at IDR 148.5 million with 1% down payment, 5% fixed annual interest rate, 20 years payment period, free VAT and free insurance premium. A quick calculation showed that the monthly installment is approximately IDR 970 thousand which requires a monthly salary of IDR 3.25 million. Unfortunately, only low-income communities with monthly income less than IDR 4 million are eligible for this LCHF scheme. Not only that, a housing study said that there is only 1.76% housing supply in Jakarta that have a price range of under IDR 300 million. Meaning that the millennial generation which fall into middle income communities cannot apply for LCHF scheme.

The continued growth in the property market will certainly be followed by an increase in landed house prices, making it difficult for the millennial generation to reach the selling price. The provision of vertical housing is considered to be able to overcome the problem of the need for decent housing. In response to the issues highlighted above, this paper aims to examining factors that are considered by medium segment consumers in housing selection,

which include not only the price but also the safety and health factors.

2. Research Method

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 as presented on Table 1.

The second stage is a Focus Group Discussion, which consists of owners and/or users to find out what are their criteria in purchasing medium segment vertical housing. The result of Focus Group Discussion is presented on Table 2, which confirmed that those five factors of Building Safety and Health serve as the main purchasing criteria.

In the next activity, a survey questionnaire and interview questions will be formulated based on the outcome of the literature review and Focus Group Discussion. Then, a pilot study using the questionnaire will be conducted to determine the validity and reliability of the questions. Based on the result of pilot study, data collection will be conducted by distributing the valid and reliable questionnaire to the owners and/or user (excluding the participants of Focus Group Discussion) in Jakarta province. The province of Jakarta is chosen for this research because it is one of the most active provinces in Indonesia in terms of housing development. At the same time, Jakarta province is facing a critical issue on housing, not only the availability of housing, but also in relation to its safety and health performance.

Based on the previous study in safety and health of low-cost housing [1], the approach of PLS-SEM (Partial Least Square - Structural Equation Modeling) was used, either to model and calculate its value indicator. Additionally, the PLS-SEM is very useful to model and simulate in order to determine the significant factors from the constructed model [2]. Subsequently, sampling selection on housing and settlement research is a critical point to find out the model to describe the existed phenomenon. According to Abadi [3] stated that the approach of sample determination in housing and settlement research is presented as in Fig. 1.

Additionally, for supporting scientific study, a number of data either quantitative or qualitative are really important to interpret the data behavior [4]. Generally, for those researchers in social area are tend to adopt qualitative research. It needs more data collection through in-depth interview, forum group discussion (FGD), and field observation. Whereas, for those scientific researchers who frequently conduct explanatory research are tend to adopt quantitative research which are involving laboratory experimental, survey, and field observation.

According to Neuman [4], the consideration in determining data collection is confined to the sample size, cost, time, and data access. However, Freedman stated that the consideration in quantitative research is limited to the representative of model, source of sample bias, error rate, response level obtained.

The following stage to conduct a proper data collection is to determine sample frame and this is the important part in data gathering process [4]. Moreover, [4] added that the parameter which is implemented in the questionnaire should not be duplicated. [3] stated that the sample frame depicted in research formula is one of critical parameters to collect a number of housing and settlement data. The accuracy level of sample frame is limited to its sample size. However, cost is a main issue of this approach, since the more data size required, it will be impacted to the cost.

In starting research regarding housing and settlement, it really important to have a vision of data source which is involved in data collection. According to [3], the reliable data source in housing and settlement are real estate directory, list of building taxpayers, map and housing location, and list of building permits.

Once it done, the next stage is sample determination method. The determination either random sample or non-random sample is depending on the availability of sample frame [3]. To conduct a random sampling, it needs to be completed through inferential statistic which is limited to population size, and sample size. Hence, all samples can be used to generalize in certain representatives. Moreover, non-random sampling can be carried out if the sample is not used to generalize and it can be completed in a relatively concise time.

According to [4], simple random sample is the simplest method in which each of elements has the same probability to be chosen. However, this method is rarely adopted due to the difficulty to get a data series regarding to highly population level. Subsequently, systematic random sample is a modified of simple random sample. This method determines a sample randomly by choosing elements in sample frame randomly and taking element-n. As compared to simple random sample, this method is more reliable.

The following method to sampling data is stratified sampling. This method contains various information regarding elements of population. It can improve the accuracy of sample by distinguishing it based on certain elements. According to [5], each sample taken from sub-population will have a higher level of representative as compared to simple random sample and systematic random sample.

In addition, there is also another way to determine a sample which is called as multi-stage sampling. It can be adopted if there is no existed sample frame. This method is carried out by determining primary sampling unit and it followed by secondary sampling unit [5]. Cluster sample is considered as multi-stage sampling, it is allowed if there is no existed sample frame or scattered population. This method tends to involving in a group instead of individual sampling. It impacted to the cost of sampling that will lead to be more efficient. However, due to the efficient of sampling method it will lead to the lack of accuracy of sample. Additionally, the type of cluster sample tends to homogeneous as compared to non-cluster. It will lead to the inaccuracy of cluster sample and it needs sufficient data [5].

Table 1 - Building safety and health factors from previous studies (source: Ramli, et al. [1])

Construct	Item	Parameter	Ali, et al. (2010)[6]	Al-Homoud & Khan	Aziz & Ahmad (2012a) [8]	Chohan, et al. (2011) [9]	Husin, et al. (2012) [10]	Isnin, et al. (2012) [11]	Karim (2012) [12]	Omar (2008) [13]	Salfarina, et al. (2010) [14]	Wong, et al. (2006) [15]	Yau, et al. (2008) [16]	Zainal, et al. (2012) [17]
Architecture	AR1	Means of Escape	V	V						V		V	V	
	AR2	Means of Access	V	V		V	V			V		V	V	
	AR3	Building Material			V			V			V			
	AR6	Fire Resistant Construction								V			V	V
Building Services	BS1	Electricity Supply	V	V		V								
	BS2	Lighting Ventilation	V											
	BS3	Air Conditioning Plumbing	V			V	V		V					
	BS4	Sanitary Service Fire	V							V				
External Environme	EE1	Emergency Service											V	
	EE3	External Hazards						V						
	EE	Air Quality			V			V						
	EE	Peaceful Environment						V		V	V			
	EE	Aesthetics			V			V		V				V
Operation Maintenance	OM1	Building Peripherals Structural & Finishes											V	
	OM2	Integrity	V			V	V							V
	OM3	Building Service Condition	V								V			
	OM4	Transformation of Building						V						
	OM5	Fire Compartment Integrity											V	
Management Approach	MA1	Emergency Evacuation											V	
	MA2	Documentation & Evaluation									V		V	
	MA3	Safety Education Security Management	V											
	MA5	Occupant Safety Management						V		V				
	MA6	Waste & Cleaning Service							V					

Another type of multi-stage sampling is area probability sampling (Abadi, 2006). It is a costly method and should be adopted if there is no sample frame but all samples are to be investigated. The basic method adopted in this sampling method is stage cluster. That method developed to produce sample based on the procedure of random sample determination. Furthermore, random sample is not always to be chosen as first method in housing and settlement study [3]. The method can't include minority group to be considered as a population.

According to [18], random samples are not necessary if researchers want to explain specific conditions with an exploratory approach. The best random sample will not help improve the accuracy of research results if the sample

response level is poor. Here is a number to determine non-random sampling such as quota sampling, judgment sampling, and snowball sampling. In using quota sampling, each of element of population is determined and it followed by taking each of its parts proportionally. Moreover, judgment sampling (purposive sampling) is need to be adopted based on the selection of population character. The samples have important characteristics that allow them to be studied and taken based on scientific considerations. In research in housing and settlements, this technique is usually used to handle research with a case study approach.

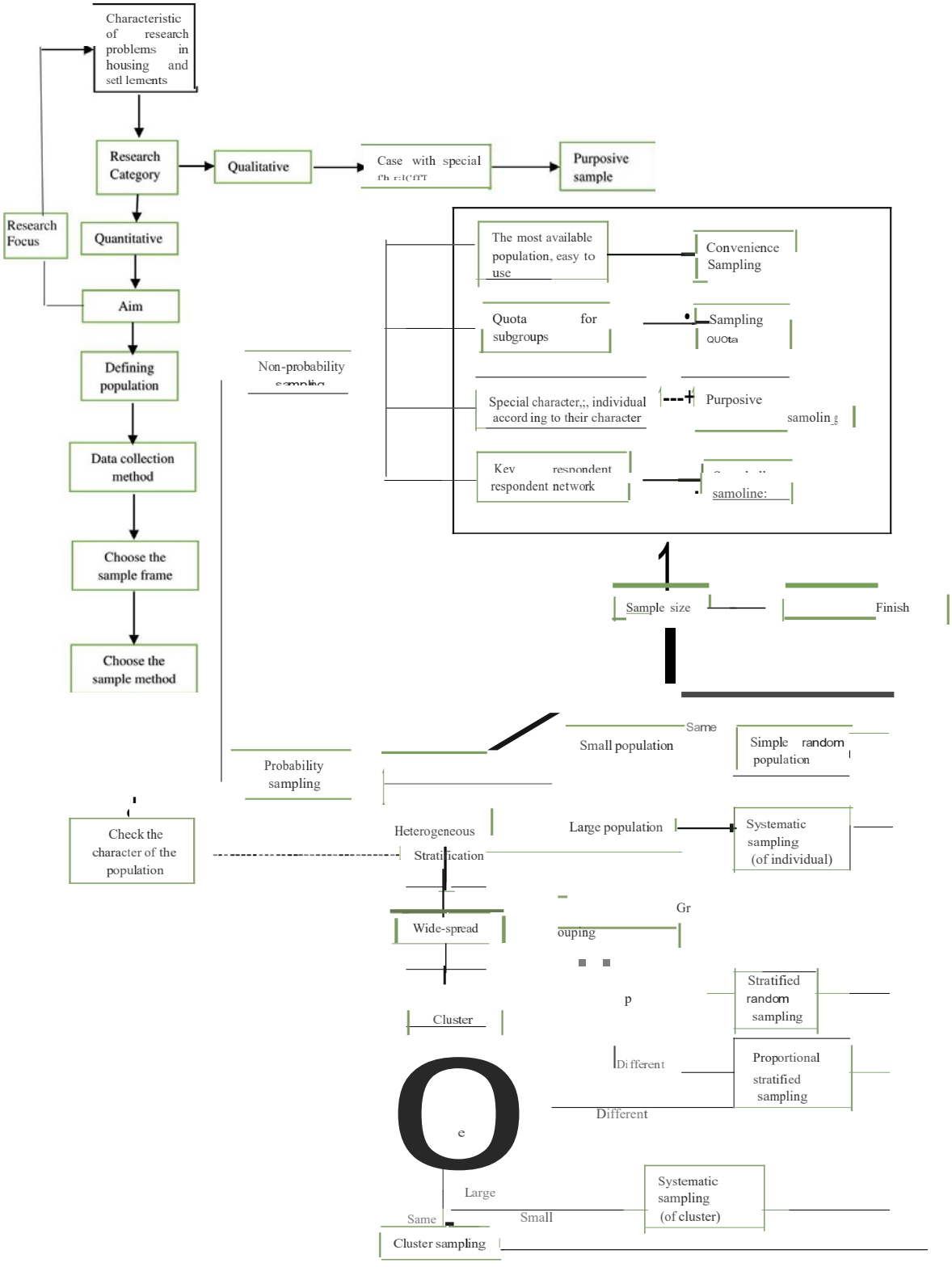

Fig. 1 -Sampling selection on housing and settlement research [3]

Table 2 - Building safety and health factors from Focus Group Discussion (source: Ramli, et al. [1])

Construct	Ite	Parameter	R	R	R	R	R	R	R	R
Architectur	AR	Means of Escape		V						
	AR	Means of Access	V			V		V		V
	AR	Building Material		V						
Building	BS	Electricity Supply	V							
Services	BS	Lighting	V							
	BS	Ventilation	V			V				V
	BS	Air Conditioning	V	V	V	V	V	V	V	V
	BS	Plumbing								V
	BS	Sanitary Service	V			V		V		
	BS	Fire Service			V	V			V	
	BS	Lifts		V					V	V
External	EE	Emergency Service		V						
Environme	EE	External Hazards								
	EE	Air Quality	V			V				
	EE	Peaceful Environment	V					V		
	EE	Aesthetics							V	V
Operation	OM	Building Peripherals								
Maintenanc	OM	Structural & Finishes		V						
	OM	Building Service Condition		V	V				V	
	OM	Transformation of Building		V	V	V	V		V	V
	OM	Fire Compartment Integrity								
Manageme	MA	Emergency Evacuation Plan					V	V		
Approach	MA	Documentation & Evaluation								
	MA	Safety Education					V			
	MA	Security Management	V					V	V	
	MA	Occupant Safety							V	
	MA	Waste & Cleaning Service	V			V		V		

R1 – R8 = Respondent no.1 – no.8

Snowballing sample is another method in the category of non-random samples, usually used to explain social patterns or communication of a society. Samples are collected from a group whose members are difficult to access, without first setting the sample frame. The sample is obtained based on information from the previous sample and therefore this method does not guarantee that the sample truly represents the population, but can be used to collect detailed information.

3. Partial Least Square-Structural Equation Modeling (PLS-SEM)

Structural equation modeling techniques are graphical equivalents of a mathematical representation [19] of the relationship between theoretical constructs [20]. This is considered an extension of the standard regression modeling method which includes various statistical tools including confirmatory factor analysis, multiple linear regression, path analysis, variance analysis, and so on [21]. This method is a good method for analyzing models with independent and less variable variables ideally for many research problems in the field of construction and management techniques [22]. At present, structural equation modeling is a quasi-standard in management research when analyzing the causation of the relationship between latent variables [23]. Structural equation modeling consists of 2 sub-models, including: measurement models and structural models [24]. The measurement model takes into account the relationship between each latent variable and manifest variables that are appropriate to determine how well measured in terms of observed or measured variables. In addition, the structural model explains the relationship between each latent variable [24] and allows analysts to make substantive statements about the relationship between latent variables [23]. Structural equation modeling makes it possible to assess these relationships using two approaches: covariance based on structural equation modeling and components based on structural equation modeling better known as PLS-SEM.

3.1 Why PLS-SEM?

SEM is a framework for exploring the relationship between research variables. This is a method that is useful for developing and testing complex causal relationships between variables. In general, there are two different approaches used in structural equation modeling [25]. Among others:

(i) Covariance Based on Structural Equation Modeling (CB-SEM). This method develops a theoretical covariance matrix in several approaches that the differences between theoretical covariance matrices and covariance matrices

are estimated to be minimized [26]. The statistical goal of this technique is to get goodness-of-fit. However, goodness-of-fit does not always mean a good model. This only means that the implied correlation corresponds to what is observed. Thus, the theory used to support the model becomes the most important thing in applying CB-SEM.

(ii) Variance Based on Structural Equation Modeling (VB-SEM) / Partial Least Square - Structural Equation Modeling (PLS-SEM). This is also called basic component SEM or PLS path modeling in the literature. The approach of PLS-SEM aims to maximize the variance described from the dependent latent construct [27]. Thus, the whole process is designed to maximize estimates rather than goodness-of-fit. PLS-SEM can be applied not only in confirmatory analysis, but also in exploratory studies where theoretical background may be lacking. Compared to the CB-SEM method, PL-SEM is stronger with fewer identification problems and works better with smaller and larger samples. In addition, in using the PLS method there were no previous distributional assumptions.

The usefulness of hierarchical modeling is quite clear in both methods of CB-SEM and VB-SEM / PLS-SEM [28]. The choice of method must be based on the objectives of a particular research project [29]. Thus, it is very important to understand the philosophy of differences between these two approaches to choosing the right method for the study to be conducted. The main requirements for making decisions in choosing the SEM approach are as follows:

(i) Purpose of research: CB-SEM is the most suitable method if the purpose of the study is to test theories, confirm theories, or comparisons of alternative theories [29]. On the other hand, the main reason for using PLS-SEM is exploration and prediction because PLS path modeling is recommended in the initial stages of theoretical development to test and validate exploration models. Another strong feature of PLS path modeling is that this approach is suitable for predictions of research orientation and reduces the variance of all dependent variables [27]. Thus, this methodology guides researchers who have a focus on endogenous constructs. Thus, if the goal of the researcher is to predict the key target construct or identify the constructor's "driver" key PLS-SEM is the most appropriate approach [29].

(ii) Sample size: CB-SEM is the most suitable method if the purpose of the study is to test theories, confirm theories, or comparisons of alternative theories [29]. On the other hand, the main reason for using PLS-SEM is exploration and prediction because PLS path modeling is recommended in the initial stages of theoretical development to test and validate exploration models. Another strong feature of PLS path modeling is that this approach is suitable for predictions of research orientation and reduces the variance of all dependent variables [27]. Thus, this methodology guides researchers who have a focus on endogenous constructs. Thus, if the goal of the researcher is to predict the key target construct or identify the constructor's "driver" key PLS-SEM is the most appropriate approach [29].

(iii) Data characteristic: The assumption of the CB-SEM approach is multivariate normality and this is suitable for normal data dissemination [29]. For non-normal or unknown data dissemination, PLS techniques are more appropriate to use [27].

(iv) Specification of the measurement model: Although, CB-SEM can overcome both reflective and measurable formative, but for formative measurements with CB-SEM, it requires an accounting approach to relatively complex specifications and limited rules [29]. PLS can overcome both reflective and formative measurement models [30].

4. Findings and Discussion

Out of 8 respondents participated in the Focus Group Discussion (FGD), 5 were males and 3 were females. Additionally, in-term of their background academics qualification, all of the respondents are master and doctoral degree holders. Hence, the respondents are quite competent to participate in the FGD. In determining the selection criteria for vertical housing with relation to the safety and health aspect, in the first round of FGD, the respondents were asked to choose the preference based on the Table 1. The result of their preference is presented in Table 3.

Table 3- Preferred criteria for flats

Criteria	Number of respondents
Building services	4
Architect	2
External environment	2

The most preferred criterion for flats is building services which comprised of several aspects such as electricity supply, lighting, ventilation, air conditioning, plumbing, sanitary service, fire service, lifts [1]. Additionally, those aspects have impact to the energy building demand. Hence, the most appropriate model considered in vertical housing should be concern in energy saving as well. In the second round of FGD, the respondents were asked to choose their preference on building services aspect. The results are presented as in Table 4.

The most selected aspect of building services from Table 4 are electricity supply, plumbing and sanitary service. This means that the preference of vertical housing design comes up from medium age consumers which are still very hard working and mobile. It is indicated by the energy consumption and its consequence to the providing of electricity

supply. Subsequently, the following aspects such as air conditioning, lighting, and lifts are categorized in the second highest of respondent preference. It means that the consideration of health as indicated by the quality of existing indoor air quality is really important. The utilization of air conditioning in housing is very common in order to provide occupant's comfort. Additionally, the existing indoor air quality is critical for Sick Building Syndrome (SBS) as characterized by the excessive indoor CO_2 exposure. The findings revealed the categories for vertical housing selection based on the preliminary study are building service aspect with focus on electricity supply, fire service, sanitary service, air conditioning, lighting, and lifts. These aspects are expected to support system housing for safety and health. Additionally, it gives paradigm that the interaction amongst those aspects will lead to the positive way in terms of safety and health.

Then, a PLS-SEM model based on preferred criteria for flats as mentioned in Table 3 combined with safety and health consideration can be developed as can be seen in Table 5 and Fig. 2 below.

Table 4 - Preferred choice in building facilities aspects

Criteria	Number of
Electricity supply	7
Plumbing	7
Sanitary service	7
Lift	5
Lighting	5
Ventilation	5
Fire service	4
Ventilation	2

Table 5 - Safety and health indicators

Safety Indicators (S)	Health Indicators (H)
Entry Access (S1)	Indoor air quality (H1)
Assembly point (S2)	Lighting (H2)
Building age (S3)	Ventilation (H3)
Security alarm (S4)	Waste (H4)
Tenant profile (S5)	Visual comfort (H5)
Firefighting training (S6)	Existence of insects (H6)
CCTV monitoring (S7)	Odor (H7)
Social problem (S8)	Water (H8)
Building management policy (S9)	
Building design (S10)	
Building material (S11)	

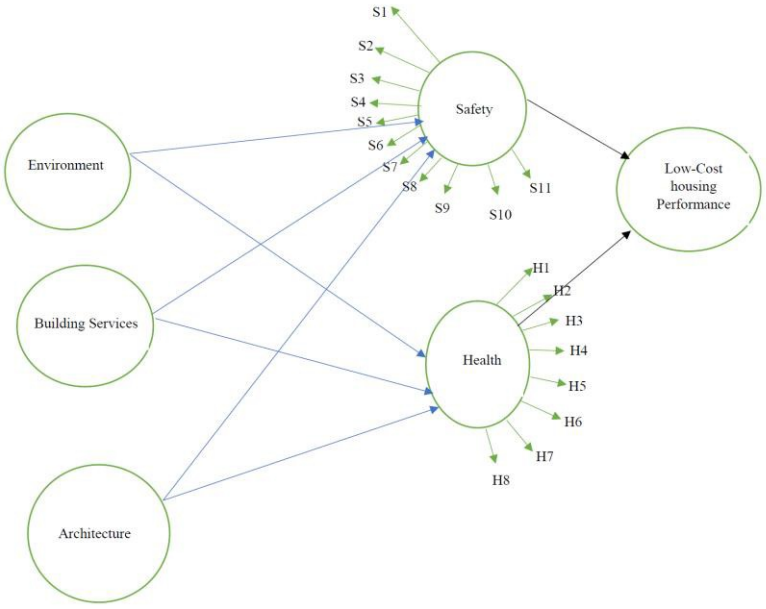

Fig. 2 - Fundamental model of safety and health development factors

5. Conclusion

This study serves as a preliminary study to identify a number of selection criteria for medium segment vertical housing. Additionally, the sampling preparation was discussed as well in order to be highlighted in the further study. The findings indicated that the building services determined the vertical housing selection on medium segment. The detail aspects of building services such as electricity supply, ventilation, air conditioning, lighting, plumbing, sanitary service, fire service, and lifts act as predictors towards the existing condition of building services. Hence, it is important to keep in mind that those aspects are critical role in determine a safety and health of vertical housing. The next stage is to develop questionnaire and distribute it to the owners and / or tenants of vertical housing / flats in surrounding Jakarta and the filled-in questionnaires will be used for confirmatory and exploratory analysis to the preliminary model PLS-SEM in Fig. 2.

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