Weighting variables for building performance evaluation

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Abstract. Building performance appraisal needs to be done as a form of evaluation, so that the level of usability of a building can be seen at the operation and maintenance stages. The purpose of this study is to give weight to the variables used in evaluating the performance of a building. In this study, the identification of building performance variables is based on literature studies and semi-structured interviews from the experts of the field. The determined variables are then filtered using the Relative Important Index (RII) method, and weighted using the Pairwise Comparison method. All this process is conducted based on the opinion of experts who are competent in the field of building, and all stages are conducted by questionnaire. The results of the filtering and weighting of variables produce 5 (five) variables and 24 (twenty four) sub-variables used in building performance evaluation, with the results of weighting for safety variable with a weight of 59.2%, health variable with a weight of 24.6%, comfort variable with a weight of 10.2%, ease variable with a weight of 4.3%, and utility variable with a weight of 1.8%.

Keywords: infrastructure management, variable weighting, building performance evaluation

1. Introduction

The construction of high rise buildings in Indonesia is increasing from year to year. Increased construction of multi-storey buildings occurs due to increasing population conditions, economy, and reduction of land area. Building construction was also done to support government programs such as the master plan for accelerating economic development according to Regulation of the Minister of Public Works and Public Housing No. 22 / PRT.M / 2018 [1].

The role of buildings is very important in the development of a country's progress because according to Regulation of the Minister of Public Works No. 24/PRT/M/2008 [2] regarding Guidelines for Building Maintenance and Repairs, the function of the building is as a place for humans to carry out their activities, as a place to both live, religious activities, business activities, social activities, culture, as well as special activities and general activities.

Based on Law of the Republic of Indonesia No. 28 of 2002 regarding Buildings [3], the definition of a building is a physical form of the results of construction work that is integrated with the place of domicile, partly or wholly on top and/or in land and/or water, which functions as a place humans do their activities, both for residential, business activities, social activities, culture, and for special activities.
To maintain the function of the building as an asset, proper infrastructure asset management is needed. Infrastructure asset management is a program or knowledge to manage an infrastructure so that it can continue to function properly, continuously as long as it is still needed, economically, efficiently, effectively, and meet the principles of green or sustainability [4]. Infrastructure asset management must be based on good knowledge of the characteristics of the infrastructure being managed or discussed because infrastructure characteristics can be very different from one to another.

One of the stages in asset management is the evaluation of the performance of assets. In buildings, performance can be measured from 4 (four) requirements, namely: functional requirements (related to building functions), performance requirements (related to the physical performance of buildings and complete installation of facilities and infrastructure), legality requirements and compliance with regulations, and user requirements (related to the convenience and costs that users must spend [5].

The government provides rules regarding the construction of buildings to control land use, spatial planning, and impact on the environment and humans. Law of the Republic of Indonesia No. 28/2002 is a government regulation regarding building construction, the implementation of which is regulated in Government Regulation of the Republic of Indonesia No. 36 of 2005 [6]. The law states that construction of buildings must meet administrative and technical requirements. One of the administrative requirements of a building is a building permit and the building technical requirements in the form of building reliability which includes aspects of safety, health, comfort and ease.

The Ministry of Public Works and Public Housing is one of the Ministries that has the task of managing state assets under the supervision of the Ministry of Finance as the manager of state assets.

In accordance with Presidential Regulation No. 15 of 2015, the authority for building infrastructure construction is the Ministry of Public Works and Public Housing, assigned to an Echelon I (one) level organizational unit within the Ministry of Public Works And Public Housing, namely the Directorate General of Human Settlements (DG of Human Settlements). One of the assets that is the responsibility of the Ministry of Public Works and Public Housing, through DG of Human Settlements, to manage properly is buildings [7].

The number of buildings in the Ministry of Public Works and Public Housing office is approximately 10 (ten) units, one of which is the Directorate General of Human Settlements building and the Directorate General of Highways building. The two buildings are two of the oldest buildings in the Ministry of Public Works and Public Housing. From 2010 to 2015, many new and higher buildings were built around the buildings with the latest and best standards, and the main building (Ministerial Building) is one of the newest examples of buildings, with green building standards and utility standards as well as supporting facilities and infrastructure. Therefore, it is better and more complete.

In Indonesia, one of the basic regulations used as a reference to determine the performance evaluation variable of buildings is the Regulation of the Minister of Public Works and Public Housing No. 27/PRT/2018 regarding Certificate of Worthiness of Building Function [8]. In this Ministerial Regulation, it is explained that there are several variables that can be used as a requirement for assessing building performance, in terms of building administrative requirements, technical requirements, building layout requirements, and building reliability.

Having been established for a long period of time, the Directorate General of Human Settlements building and the Directorate General of Highways building will naturally experience a decline in performance. This decline in performance can have an impact on the operation and maintenance of the buildings. In terms of operations, it will hamper the main tasks and functions of the buildings as an office.
While in terms of maintenance, it will need to be done in the form of routine maintenance (daily), monthly or yearly to maintain building performance in operational terms [9].

Therefore, it is important to identify the building performance variables, specifically the Directorate General of Human Settlements Building and the Directorate General of Highways Building. This study aims to weight each variable in evaluating a building by using performance evaluation variables in terms of building reliability.

2. Literature Review

Research on building performance has been carried out by many researchers. Antonius & Poedjiaustoeti [10] conducted research on evaluating environmental conditions and structures in public buildings (with a case study: Performance of Two Buildings in Semarang). The research method used is descriptive analysis on As Built Drawings. The research aims to evaluate environmental conditions and structures in buildings.

Selowati & Indryani [11] conducted a study with the topic of the feasibility analysis of The Via and The Vue Surabaya apartments in terms of architecture. This descriptive analysis method research aims to determine the performance of buildings related to the demands of comfort and health of the buildings as well as matters that are at high risk to human safety based on applicable standards and regulations.

Research that evaluates building damage was carried out by Ery [12]. This research on the topic of determining the performance variables of educational building used the analytical hierarchy process method. The purpose of the study was to assess the damage to the Politeknik Pos, Politeknik Negeri Bandung, and Politeknik Manufaktur buildings; both through visual inspection and testing, as well as non-destructive testing for latent damage. From this study, the weight of each building component can be calculated which is reflected in the performance requirements of building reliability, such as security, safety, health, comfort and accessibility of building requirements.

This study has similarities with the previous studies which were evaluating the performance of buildings. However, in this study, the scope of building performance evaluation only addresses the technical requirements of buildings in terms of reliability.

In Indonesia, the provisions governing buildings are regulated in several statutory regulations, including the Law of the Republic of Indonesia, and also the Minister of Public Works and Public Housing Regulation. Starting from the Law of the Republic of Indonesia Number 28 of 2002 regulating Buildings, Regulation of the Minister of Public Works Number 24 / PRT / M / 2008 on Guidelines for Building Maintenance and Repair, Regulation of the Minister of Public Works Number 45 / PRT / M / 2007 on Technical Guidelines for Building Construction of State Building [13], Regulation of the Minister of Public Works Number 05 / PRT / M / 2007 on the Technical Guidelines for High-Rise Simple Flats [14], Regulation of the Minister of Public Works No. 30 / PRT / M / 2006 on the Technical Guidelines for Facilities and Accessibility in Buildings and Environments [15].

In measuring the performance of building infrastructure, there are many variables that can be used from various literature studies. However, this research only uses the Minister of Public Works and Public Housing Regulation No.27 / PRT / M / 2018 because this regulation is the latest regulation issued by the Ministry of Public Works and Public Housing as a guide in regulating building performance. Among the sub-variables that will be used, if there are almost similar sub-variables, they will be summarized into one sub-variable that is considered representative. Considering previous research, the variables and sub-variables that are relevant to be applied in Indonesia as shown in table 1.
| No | Variables                                      | Sub-Variables                                                                                   | Source                                                                                      |
|----|------------------------------------------------|-----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| 1  | Allotment of buildings                         | Conformity of building function with designation in regional spatial planning or building and environmental plannings | Regulation of the Minister of Public Works and Public Housing of the Republic of Indonesia Number 27 / PRT / M / 2018 |
| 2  | The intensity of the building                  | Building density, Building height, Clearance of buildings                                        | Regulation of the Minister of Public Works and Public Housing of the Republic of Indonesia Number 27 / PRT / M / 2018 |
| 3  | Building architecture                          | Appearance of buildings, Inner space layout, Balance, Harmony, The harmony of the building with its environment | Regulation of the Minister of Public Works and Public Housing of the Republic of Indonesia Number 27 / PRT / M / 2018 |
| 4  | Control of environmental impacts               | Environmental permits for buildings in accordance with statutory provisions                    | Regulation of the Minister of Public Works and Public Housing of the Republic of Indonesia Number 27 / PRT / M / 2018 |
| 5  | Safety                                         | The structure of the building, Fire hazard protection, Lightning rod, Safety and reliability of electrical installations for buildings that are equipped with electrical installations, Disaster safety of public interest buildings | Regulation of the Minister of Public Works and Public Housing of the Republic of Indonesia Number 27 / PRT / M / 2018 |
| 6  | Health                                         | Ventilation system, Lighting system, Clean water system                                        | Regulation of the Minister of Public Works and Public |

Table 1. Building Performance Variables in Indonesia
In determining building performance variables and sub-variables, several countries use certain approaches and perspectives in accordance with the objectives to be achieved by building operators in the country or region. According to Daniel et al [16], Hong K ong uses 5 variables in building performance measurements consisting of structural systems, closure systems, environmental modification systems, protection systems, and utility systems which are measured through several sub-

variables on each variable.

In the Minister of Public Works and Public Housing Regulation No.27/2018, there are no variables that assess the building’s performance in terms of the utility system, even though the building cannot be separated from the utility system itself. On the other hand, for other systems such as structural systems, it has been regulated in the Minister of Public Works Regulation No.45 of 2007 concerning Technical Guidelines for the Construction of State Buildings in the section on building structure requirements. The closure system is regulated in the Minister of Public Works Regulation No.24/2008 concerning building structure requirements. Environmental modification and protection systems have been regulated in the Minister of Public Works and Public Housing Regulation No.27/2018 concerning Building Worthy Certificate of Building in the comfort and safety requirement sections.

In this research, variable synthesis is carried out by simplifying and grouping similar variables and sub-

variables. In general, this study uses 5 (five) variables, where 4 (four) variables, namely safety, health, comfort, and ease are taken from the Minister of Public Works and Public Housing Regulation No.27 of 2018, and the 5th variable is utility system which is taken from Daniel et al. [16]. This is done because this research only evaluates building performance in terms of reliability.

3. Research Method
To identify building performance variables within the Ministry of Public Works and Public Housing, variables that affect the buildings’ performance evaluation appropriately need to be determined. In Indonesia, one of the basic regulations used as a reference for determining building performance

| No | Variables | Sub-Variables | Source |
|----|-----------|---------------|--------|
| 7  | Comfort   | Comfort of wiggle room | Regulation of the Minister of Public Works and Public Housing of the Republic of Indonesia Number 27 / PRT / M / 2018 |
|    |           | Comfort of air conditions in the room | |
|    |           | Comfort of the view | |
|    |           | Comfort from vibration and noise | |
| 8  | Ease      | Ease of connection to, from, and inside buildings (means of horizontal relationships between spaces / between buildings | Regulation of the Minister of Public Works and Public Housing of the Republic of Indonesia Number 27 / PRT / M / 2018 |
|    |           | vertical connection between floors in buildings and evacuation facilities) | |
|    |           | Completeness of infrastructure and facilities for building utilization | |
evaluation variables is the Regulation of the Minister of Public Works and Public Housing No. 27 / PRT / 2018 regarding Certificate of Worthiness of Building Function. It is explained that there are several variables that can be used as a requirement to evaluate building performance, from both in terms of building administrative requirements, technical requirements, building layout requirements, and in terms of building reliability.

The evaluation related to building performance, either private or government buildings, has been reviewed by several researchers. The assessment variables used are also diverse, some of which examine all aspects of structure, architecture, accessibility, and building, and environmental governance. However, there are also those who only evaluate from one aspect.

The method used in the previous research included a descriptive analysis that was considered less accurate in determining influential variables or sub-variables. In other studies, multidimensional scaling and interpretive structural modelling which are quite difficult to implement were used. As for this research, the method includes identifying variables which is done by literature studies and preliminary survey. Literature studies are taken from the rules and previous research results, in which there are variables and sub-variables needed in research. Meanwhile, the preliminary survey is carried out by discussion and consultation of experts who are considered competent in the field of building to ensure the suitability of the variables and sub-variables used in accordance with the research objectives. The next stage is distributing questionnaires, to filter variables that are used. This is done to ensure that the sub-variables used are really important in the opinion of respondents who are experts in the field of building, using the relative important index (RII). This method was chosen because from the results of the questionnaire collected, it can be analysed using statistical tests and RII at the same time, making it more practical in data collection and more comprehensive in the determination of sub-variables. The weighting method uses a paired comparison questionnaire which is one of the stages in the Analytical Hierarchy Process (AHP).

The pairwise comparison method is used because this research does not determine alternatives such as the AHP, but only determines the importance weight. On the other hand, not everyone understands and understands the selection of variables and sub-variables used in this study, so that the respondents chosen are organizers in the field of building construction, in this case the Directorate of Building Management as an institution that has the task of carrying out the formulation and implementation of policies, preparation of technical plans, and implementation of building the buildings. Based on this consideration, the pairwise comparison method is considered more appropriate in determining the weights. This is also in accordance with the opinion of Sarachaga [17] which states that AHP is used because of its simplicity and flexibility when combined with other methods.

Population in this study is officials who are still active at the structural level of Directorate of Building and Neighbourhood Development, Directorate General of Human Settlements, officers at the General Affairs Division of Secretariat of Directorate General of Human Settlements, and officers at the General Affairs Division of Secretariat of Directorate General of Highways) in the Ministry of Public Works and Public Housing.

This study uses non-probability sampling, which is a technique that does not provide equal opportunity for each element or member of the population to be selected as a sample. The method used is purposive sampling which is a sampling technique with certain considerations and cannot be given to everyone randomly. This is because not everyone understands the selection of variables and sub-variables used in this study.

4. Research Analysis

4.1. Identification of Building Performance Evaluation Variables
This study uses research variables in the form of variables and sub-variables taken based on literature studies particularly the Regulation of the Minister of Public Works and Public Housing No. 27 / PRT / 2018 regarding Certificate of Worthiness of Building Function, previous research by adding 1 (one) building performance variable, namely utility system, and preliminary surveys that have been carried out in the previous stages. All variables and sub-variables that are considered relevant for building performance measurements are identified and refined to be used as variables and sub-variables based on table 2.

| Variable     | Code | Sub-Variable                                                                 |
|--------------|------|------------------------------------------------------------------------------|
| Safety       | X1.1 | Strong building structure                                                    |
| Aspects (X1) |      |                                                                              |
|              | X1.2 | Fire hazard protection                                                       |
|              | X1.3 | Lightning rod                                                                |
|              | X1.4 | Safety and reliability of electrical installations for buildings that are equipped with electrical installations |
|              | X1.5 | Building disaster security                                                    |
|              | X2.1 | Ventilation system                                                           |
|              | X2.2 | Lighting system                                                              |
| Health       | X2.3 | Clean water system                                                           |
| Aspects (X2) |      |                                                                              |
|              | X2.4 | Dirty and/or waste water disposal system                                      |
|              | X2.5 | Sewage and sewage system                                                      |
|              | X2.6 | Rainwater delivery system                                                     |
|              | X3.1 | Comfort of space                                                             |
| Comfort      | X3.2 | Comfort of air condition in the room                                          |
| Aspects (X3) |      |                                                                              |
|              | X3.3 | View comfort                                                                 |
|              | X3.4 | Vibration and noise comfort                                                   |
|              |      | Ease of relationship to, from, and inside buildings (means of horizontal relations between spaces / between buildings and facilities of vertical connections between floors in buildings) |
| Ease Aspect  | X4.1 |                                                                              |
| (X4)         |      |                                                                              |
|              | X4.2 | Evacuation facilities                                                         |
|              | X4.3 | Completeness of infrastructure and facilities for building utilization       |
|              | X5.1 | Underground and aboveground piping system                                     |
| Utility      | X5.2 | Underground and aboveground drainage system                                   |
| Aspects (X5) |      |                                                                              |
|              | X5.3 | Low and high volt electrical installations                                    |
|              | X5.4 | Elevator                                                                     |
|              | X5.5 | Gas installation                                                             |
|              | X5.6 | Other large installations (Waste Water Treatment Plant/WWTP)                  |

4.1.1. Variables Filtering
Variables filtering are done to eliminate variables in the form of sub-variables that are considered not important for the purpose of the assessment by the Relative Important Index (RII) method. With variable filtering, it is expected that the sub-variables that will be used can measure the performance of buildings properly. Decision making in RII is based on a minimum value of $\geq 0.750$ so that a variable and sub-variable are considered important and influential. The summary of the questionnaire variable filtering based on survey can be seen in table 3 as follows:
Table 3. Variables Filtering

| Variables   | Code | Total | Resp. | Score   | Note |
|-------------|------|-------|-------|---------|------|
| Safety      | X1   | 57    | 13    | 0.8769  | Used |
| Health      | X2   | 53    | 13    | 0.8154  | Used |
| Comfort     | X3   | 55    | 13    | 0.8462  | Used |
| Ease        | X4   | 52    | 13    | 0.8000  | Used |
| Utility     | X5   | 55    | 13    | 0.8462  | Used |

Based on the table above, it can be seen that all variables can be used in the next analysis, namely weighting variables. The results of sub-variable filtering based on the questionnaire can be seen in table 4 as below:

Table 4. Sub-Variables Filtering

| Sub-Variables          | Code  | Total | Resp. | RII  | Decision |
|------------------------|-------|-------|-------|------|----------|
| **Safety Aspects (X1)**|       |       |       |      |          |
| Strong building structure | X1.1 | 56    | 13    | 0.86 | Used    |
| Fire hazard protection | X1.2 | 54    | 13    | 0.83 | Used    |
| Lightning rod          | X1.3 | 50    | 13    | 0.76 | Used    |
| Safety and reliability of electrical installations for buildings that are equipped with electrical installations | X1.4 | 55    | 13    | 0.84 | Used    |
| Building disaster security | X1.5 | 52    | 13    | 0.80 | Used    |
| **Health Aspects (X2)**|       |       |       |      |          |
| Ventilation system     | X2.1 | 56    | 13    | 0.86 | Used    |
| Lighting system        | X2.2 | 55    | 13    | 0.84 | Used    |
| Clean water system     | X2.3 | 61    | 13    | 0.93 | Used    |
| Dirty and / or waste water disposal system | X2.4 | 60    | 13    | 0.92 | Used    |
| Sewage system          | X2.5 | 60    | 13    | 0.92 | Used    |
| Rainwater delivery system | X2.6 | 56    | 13    | 0.86 | Used    |
| **Comfort Aspects (X3)**|       |       |       |      |          |
| Comfort of space       | X3.1 | 55    | 13    | 0.84 | Used    |
| Comfort of air condition in the room | X3.2 | 58    | 13    | 0.89 | Used    |
| View comfort           | X3.3 | 50    | 13    | 0.76 | Used    |
| Vibration and noise comfort | X3.4 | 53    | 13    | 0.82 | Used    |
| **Ease Aspects (X4)**  |       |       |       |      |          |
| Ease of relationship to, from, and inside buildings (means of horizontal relations between spaces / between buildings and facilities of vertical connections between floors in buildings) | X4.1 | 56    | 13    | 0.86 | Used    |
| Evacuation facilities  | X4.2 | 56    | 13    | 0.86 | Used    |
| Completeness of infrastructure and facilities for building utilization | X4.3 | 54    | 13    | 0.83 | Used    |
| **Utility Aspects (X5)**|       |       |       |      |          |
| Underground and aboveground piping system | X5.1 | 54    | 13    | 0.83 | Used    |
| Underground and aboveground drainage system | X5.2 | 55    | 13    | 0.84 | Used    |
| Low and high volt electrical installations | X5.3 | 56    | 13    | 0.86 | Used    |
| Elevator               | X5.4 | 54    | 13    | 0.83 | Used    |
4.1.2. Weighting Variable Results

After 24 sub-variables are selected, a paired comparison questionnaire will be re-arranged to determine the importance of the variables and sub-variables. Taking into account the opinions of experts through a weighting questionnaire given to 13 (thirteen) respondents at the Directorate General of Human Settlements and Directorate General of Highways, the research obtains weights of 5 (five) variables, the output of which can be seen in the following table:

| Variables | Weight (%) |
|-----------|------------|
| Safety    | 59.2%      |
| Health    | 24.6%      |
| Comfort   | 10.2%      |
| Ease      | 4.3%       |
| Utility   | 1.8%       |
| **Total** | **100%**   |

After obtaining the results of weighting variables as the table above, to make it easier to visually see the results of the weighting of variables, the histogram has been made as follows:

![Figure 1. Weighting Variable Results](chart)

The safety variable gets the highest weight by 59%. This is because one of the main and important things of the operation and maintenance of a building is safety. The safety variable can be fulfilled well if the health variable can be fulfilled well, therefore the health variable gets the second highest weight of 24.7%. The operation and maintenance of a building is certain to have an impact on the health of the occupants of the buildings around the Directorate General of Human Settlements building and the Directorate General of Highways building within the Ministry of Public Works and Housing. Furthermore, the comfort variable is in the third place at 10.2%. In the operation and maintenance of a healthy building, it can naturally create comfort.

In the fourth place is the ease variable with a weight of 4.3%. Although this criterion is considered important if it is associated with the evaluation of a building, but still less attention is given if viewed from the weight obtained. Meanwhile, the smallest weight is the utility variable, which is needed to
ensure the operation and maintenance of a building that meets the applicable regulations and standards, with a weight of 1.8%. With the weight of the five proposed variables, it can be seen that the safety variable is the main variable, since it is the goal of a building infrastructure management, including in building operation and maintenance. Meanwhile, the health and comfort variables still need to be increased again because based on the weight of importance gained in these variables, they do not get much attention from the building manager. The paradigm to improve the health and comfort variables in the provision of building infrastructure must be able to be instilled to all stakeholders, especially the building administrators. Thus, the five proposed variables will get a balanced weight which ranges from ± 20% percentage.

4.1.3. Weighting Sub-Variable Results

After weighting the variables, weighting is done for each sub-variable. The recap of weighting sub-variables can be seen in table 6 as follows:

| Table 6. Sub-Variables Weighting |
|----------------------------------|
| **Sub-Variables** | Weight (%) |
| **Safety Aspects (X1)** |  |
| Strong building structure | 28.3% |
| Fire hazard protection | 24.1% |
| Lightning rod | 9.1% |
| Safety and reliability of electrical installations for buildings that are equipped with electrical installations | 17.6% |
| Building disaster security | 20.9% |
| **Health Aspects (X2)** |  |
| Ventilation system | 15.6% |
| Lighting system | 9.4% |
| Clean water system | 33.1% |
| Dirty and / or waste water disposal system | 19.7% |
| Sewage and sewage system | 12.2% |
| Rainwater delivery system | 10.0% |
| **Comfort Aspects (X3)** |  |
| Comfort of space | 35.7% |
| Comfort of air condition in the room | 37.6% |
| View comfort | 8.5% |
| Vibration and noise comfort | 18.2% |
| **Ease Aspect (X4)** |  |
| Ease of relationship to, from, and inside buildings (means of horizontal relations between spaces / between buildings and facilities of vertical connections between floors in buildings) | 27.8% |
| Evacuation facilities | 29.9% |
| Completeness of infrastructure and facilities for building utilization | 42.3% |
| **Utility Aspects (X5)** |  |
| Underground and aboveground piping system | 7.6% |
| Underground and aboveground drainage system | 18.3% |
| Low and high volt electrical installations | 28.9% |
| Elevator Installation | 20.0% |
| Gas installation | 12.3% |
| Installation of Waste Water Treatment Plant (WWTP) | 12.9% |

Based on table 7 above, conclusions can be drawn as follows:
1. In the safety sub-variable, it is known that the highest weight of 28.3% is obtained by the sub-structure of the building structure. This is in accordance with the objective of the operation and maintenance of a building infrastructure that is maintaining the structure of a building, even though the maintenance of a building does not have too large effect when compared to the construction of new buildings or building upgrading or reconstruction.

2. The clean water system sub-variable has the highest weight of 33.1%, which means that the clean water system aspect has the highest importance compared to other sub-variables proposed to measure health variables in buildings that get in the operational and maintenance stages. The clean water system is related to the source or distribution system, the quality and flow of clean / drinking water. Clean water systems are negatively correlated with water shortages, meaning that the better the availability of clean water systems in a building, the better the service level of the building.

3. The comfort of air condition in space variable has the highest weight of 37.6% compared to the other 3 sub-variables proposed. This can be interpreted that according to experts, the comfort of air conditions in the room is considered important to be considered a priority, because this is related to temperature and humidity in the room.

4. The highest weight was obtained by the sub-variable of completeness of facilities and infrastructure of building utilization with a weight of 42.3%. Complete facilities and infrastructure for building utilization are the facilities that are used to facilitate building occupants, such as toilets, parking facilities, worship rooms, lactation rooms, trash bins, communication systems, information systems, and other equipment.

5. Electrical installation sub-variable gets the highest weight by 28.9%. This is because all facilities available in buildings generally use electricity, therefore, electrical installations need to be installed correctly, both low and high voltage because it is one of the sub-variables that can be dangerous for the building and its inhabitants.

5. Conclusion

After observing in the field and analysing the data, the following conclusions are obtained:

1. Through the method of relative importance index, the evaluation of the performance of buildings in the Ministry of Public Works and Public Housing produced 5 (five) filtered variables, including safety variables, health variables, comfort variables, convenience variables and finally utility variables, with 24 (twenty four) sub-variables.

2. The variable weight of buildings in the Ministry of Public Works and Public Housing consists of a safety variable with a weight of 59.2%, a health variable with a weight of 24.6%, a comfort variable with a weight of 10.2%, a convenience variable with a weight of 4.3%, and utility variable with a weight of 1.8%. Furthermore, the variable results and weights obtained in this study can be used to assess the level of building performance, especially in the Ministry of Public Works and Public Housing.

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