Post-Occupancy Evaluation on Infrastructure Service Performance of Mariso Low Cost Apartment (Rusunawa), Makassar

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Abstract. This study aims to measure the level of infrastructure service performance of Mariso low-cost apartment (Rusunawa), which is the key to the comfort of occupancy that ensure the sustainability of daily activities both physical and non-physical. Targets to achieve in this research are to formulate the infrastructure service performance according to the standard service of building infrastructure and facilities and as mandated in the standard of planning, building and evaluation of building post-occupancy. This method is used to determine the extent to which the perception of occupants responding to the results of a built environment after more than 10 (ten) years occupied. The applied research method was descriptive research method through the recording and infrastructure service performance analysis by linking between the comfort factor with the standard planning of Mariso low-cost apartment (Rusunawa). The results of the research are the recommendations on the suitability of the service standards/performance infrastructure of the building with the existing conditions of the building with attention to the variable availability of infrastructure that become the focus of research.

1. Introduction
Post-occupancy evaluation (POE) is an evaluation or diagnostic measurements to monitor the quality of the building, or post-occupancy evaluation is the systematic and accurate evaluation of a building after the complete construction of the building and occupied for some time. POE focuses on the occupants and the needs of occupants and therefore, they could provide basic information concerning the consequences of decision of past designs from the building performance result. This information will be a good basis for constructing better buildings in the future.

POE is an activity that originated from the concern with the occupied building performance. The basic approach to evaluate building performance is through the perspective of the building occupants [1]. Its main objective is to describe the relationship between building, management systems, and its occupants. The most commonly used POE scheme is through the assessment of occupant satisfaction [2]. The satisfaction derived from the comparison of the actual condition (performance) and the expected conditions (needs or interests) of residents. If the performance of the building does not meet the requirements of the occupants, dissatisfaction will occur. In addition to building performance, occupant's assessment may include other factors around the building, such as the management of facilities and the environment facilities. In this case, the occupancy system is the combination of physical and social aspects. Therefore, determining the scope of occupancy becomes very essential in identifying factors that affect satisfaction. The principle of EPH is to perform a systematic approach for improving the quality of a building which is responsive to the function desired and needed by the occupants [3].
Flats is a multi-blocks building built in an area that is structured functionally, and either horizontally or vertically. It consisted of several units that can be owned and utilized separately, primarily as an occupancy provided with collective unit, property and land [4]. A flats plan should be able to guarantee the occupancy sustainability by providing supporting facilities for environmental service for the flats. Complete utility of flats must fulfill the requirement of Government Regulation [5] regarding Technical Requirement of Flats Construction.

The aim of this study will focus on the interconnection between the standard apartment plan that is based on the standard low-cost apartment plan with the existing condition of current occupancy. Therefore, the results of the study could be formulated into recommendation focusing on the infrastructure and facility performance improvement sustaining the low-cost apartment. This research is important considering the absence of post-occupancy evaluation at Mariso low-cost apartment which has not yet reached a clear and thorough results on the infrastructure performance and supporting facilities of the flats, especially the description collected through direct recording/observation on the relevant condition.

2. Literature Review

2.1. The Philosophy and Definition of Apartment

The house or occupancy is one of the basic human needs that serve to support the implementation of the activities of human daily life. One of the main issues that metropolitan cities encounter is the unavailability of land while housing demand for urban population is on the high level [6]. One alternative to solve this problem is to develop a model of vertical housing in the flats form. Flats construction is one of the strategic ideas in providing habitable occupancy, especially for low-income communities and serving as practical solutions in overcoming urban dense settlements [7].

Flats is a multi-blocks building built in an area that is structured functionally, and either horizontally or vertically. It consisted of several units that can be owned and utilized separately, primarily as an occupancy provided with collective unit, property and land [4].

2.2. The Requirement of Flats Infrastructure Environment

Environmental infrastructure is the basic physical environmental services which are required in the flats in order to sustain the flats properly including road, elevators, hallway, drainage, waste management system and clean water. Flats environment should be supported with the following facilities:

a. The environmental infrastructure that serves as a liaison for the purposes of daily activities for the residents such as footpaths, vehicle and parking place;

b. Environmental infrastructure should consider the accessibility and harmony of the relationship in the daily activities and security when harmful situations occur, as well as the structure, size, and strength in accordance with the function and road use;

c. Clean water distribution, gas and electricity with all of the equipments such as water tank, water pump, gas tank and electrical substations;

d. Rain water sewerage connects the rain water from the flats to city water sewerage system;

e. Sewerage and / or septic that connects the waste water from the flats to the system sewage network of the city;

f. Trash, as garbage collector from the flats that will be dumped into the city dump, by considering the factors of transportation accessibility, cleanliness, health and elegance;

g. The water faucets to prevent and secure fire that can reach all places in the environment;

h. Vehicle parking and storage;

i. Telephone network and the communication equipment are in accordance with the purposes.

2.3. Flats Facilities

According to the Indonesian National Standard [8], environment Facilities are the supporting facilities that serve to the implementation and development of economic life, social and cultural rights, which encompasses commercial building or shopping center (the economic aspect), open space, education,
health, religion, government facilities and public services, parks and cemetery (the location is outside of the flats or according to the spatial plan of the city).

a. Commercial facility is a supporting facility that enables economic activity and develop economic life of residents in form of building or business court as commercial service and workplace.
b. Educational facility is a supporting facility that enables students to optimally develop their knowledge, skills, and attitude with teaching-learning strategy based on the prevailing curriculum.
c. Health facility refers to the facility that sustains resident's health that functions to control the development and growth of the population.
d. Religious facilities are the facilities used to accommodate all the activities of worship and activity support.
e. Government facilities and public service facilities which can be used for the benefit of the public service, such as security guard service, meeting hall, neighborhood or community association office, police post, fire station, post office helpers, multipurpose buildings, administrative offices.

Open space planned with specific purpose that includes desired space quality and space functions. Therefore, it does not include open spaces as the remaining spaces or planned building groups. Facilities in open space each of the space and use of space outside of buildings, such as parks, roads, pedestrian, green lane, playing field, sports field and parking.

Environment facilities of flats must meet the following requirements:
1. Providing a sense of security, peaceful life, comfort and fit with local culture;
2. Fostering a sense of belonging and to change habits that contradict with the life style in the flats;
3. Reducing the tendency to exploit or use the environment facilities for personal interests and specific groups;
4. Sustaining the most primary residential activity functions both the quantity and the types according to the existing environmental situation;
5. Accommodating functions related to the implementation and development aspects of economic and social culture.

2.4. Post-Occupancy Evaluation
Evaluation of post-occupancy is an evaluation to assess the success rate of a building in providing satisfaction of facilities to its residents. POE is performed to assess the suitability between building and built-environment with values and needs of residents, in addition to provide input in designing buildings with similar functions. POE is beneficial as short, intermediate, and long term reference and to provide improvements to increase residents’ satisfaction on building and built-environment [9]. According to statement [3], Post-Occupancy Evaluation (POE) is defined as study or assessment on buildings' fulfilment in providing and supporting the residents, especially their values and needs. POE is performed to assess the suitability between building (built-environment) and values and needs of residents and as input in designing buildings with similar functions.

The concept of building performance is the basic philosophy and theoretical ground of POE that includes behavior, quality, and amenity aspects which are measured and evaluated [3]. The concept of building performance employed measurement, comparison, evaluation, and feedback principles. These are parts of systematic approach used to improve building environmental quality which includes variation of mechanism used to build buildings more responsive to the desirable functions and the needs of residents [3, 10]. POE is performed to assess the suitability between building and built-environment with values and needs of residents, in addition to provide input in designing buildings with similar functions. POE is beneficial due to its short, intermediate, and long term reference.
2.5. **Investigation of Post-Occupancy Evaluation**

The result of indicative POE influences the identification result of the main problem. Investigative POE includes various detailed and reliable topics. The main steps of investigative POE is identical with indicative POE, with higher effort, more time-saving, and the collected data and analysis technique are more perfect. Unlike indicative POE, where the criteria of evaluated buildings are based on the experience of evaluator, investigative POE employed a more objective and explicit research criteria. Evaluation criteria of investigative POE involves, at least, two activities: estimated reference compared to facilitation reference that is similar and already exist.

2.6. **Diagnostic Post-Occupancy Evaluation**

Using more sophisticated methods with more accurate result required several months to complete. The result is a comprehensive evaluation. Diagnostic POE follows diverse strategy methods, some of them are: questionnaires, surveys, and physical measurements where all approaches are adjusted with comparative evaluation on facilities with cross-sectionally similar types. Diagnostic POE is performed in a period of several months, one year, or more. The result and recommendation will be long-term oriented with objective not only to improve the main facility, but also building type reference given. The employed methodology is identical to the traditional method which focused on the use of scientific paradigm. Diagnostic POE is generally a large scale project that involves a wide range of variables. It is not infrequent that the effort performed is to improve the results that indicate relationship between variables. Therefore, Diagnostic POE employed both data collection and perfect analysis techniques which resulted on investigative and indicative POE [11]. The important part of diagnostic POE has been investigated, while its objective has correlation physically, environmentally, and behaviorally which give better experience on various relative form criteria. All the prerequisites demanded by diagnostic POE have considerable potential in creating accurate predictions on buildings shape and provide knowledge reference on types of building given through improvement on design criteria and literature guidelines. After being occupied, the possibility of performance change is present due to incompatibility of initial planning and building utilization, therefore it is not building performance evaluation. Building, in addition to physical requirements, needs to have functions based on the activity of its residents and consequently, the interaction between building and residents exist [9, 12].

3. **Research Methods**

3.1. **Material and Methods**

This study employed descriptive qualitative method with objective to discover objective phenomenon based on observation and recording of physical and non-physical aspects of the research object. Descriptive qualitative analysis is employed to measure the comparison between the existing performance of infrastructures and supporting facilities of Mariso low-cost apartment (Rusunawa) with planning standard recommended by Ministry of Public Works in Government Regulation which regulate the minimum availability standard of infrastructures and facilities of low-cost apartment taken as research object.

The research location is administratively located in Lette, Mariso, Makassar, as shown in the following map:
3.2. Data Collection and Analysis Techniques
The data collection methods employed are observation and direct measurement for physical data, while non-physical data is recorded with direct interview on residents. The data analysis technique employed is qualitative descriptive with data grouping based on data categories which is further interpreted based on data categories, including comparison between planning standards and the availability of infrastructures and supporting facilities.

4. Results and Discussion
This research is directed to post occupancy evaluation of infrastructures in Mariso low-cost apartment (Rusunawa) using references that regulate Ordinances of Environmental Facilities of Low-Cost Apartments, standards of environmental infrastructures of housing and settlement, and standards and technical regulations on environmental management of housing and settlement. In general, the research object (flats Mariso) is consisted of 6 five-story building blocks (1-4 floor for housing and ground floor for parking area). The size of house unit is 4x6 m with units per floor are 12 rooms. The total available room is 288 units with 1,152 total residents. The occupation of the residents is dominated by laborers and fishermen.
Following is the performance analysis of the flats infrastructures based on reference/standard infrastructures of settlement as mentioned above.

4.1. The Availability of Commercial Infrastructure
Commercial infrastructure is supporting infrastructure that enables economic activity and develop economic life of residents in form of building or business court as commercial service and workplace. Object of the study related to the performance of commercial infrastructures includes:
1. Stalls
2. Stores
3. Shopping center and business services

The standards of the commercial infrastructures above is presented in the Table 1.

| Available Facilities | Minimal number of residents to be served (each unit of facilities) | Function                          | Location and maximum distance from the residential unit | Location and position at the building floor | Floor width | Land area (if it is a separate building) |
|----------------------|---------------------------------------------------------------|-----------------------------------|---------------------------------------------------------|------------------------------------------|-------------|-----------------------------------------|
| Stalls               | 250 residents/50kk                                           | Staple Food Seller                | 1. Located at the center of the environment             | Located at the ground floor              | 18-36 M     | 72M² (with BCR 50%)                     |
|                      |                                                                |                                   | 2. Accessible                                           |                                          |             |                                        |
|                      |                                                                |                                   | 3. Maximum 300 M radius                                 |                                          |             |                                        |
| Stores               | 2500 residents                                               | Selling daily necessities including clothing and food | Located at the center of the environment with access of 500 M radius | Located at the separated building       | ± 50 M²     | 100 M² (with BCR 50%)                   |
| Shopping Center and Business Services | ≥ 2500 residents                        | Selling clothing and food needs and services | Located at the center of the environment with access of 1000 M radius | Located at the separated building       | ± 600 M²    | 1200 M² (with BCR 50%)                 |

Source: National Indonesian Standards [14]

Total residents of 1,152 residents, the mandatory infrastructures in residential environment is stalls with an analysis as follows:
1 stall is reserved for 250 residents. Therefore, based on National Indonesian Standard [14] the number of stalls need to be prepared is 1,152/250=4.6 = 5 units. Recordings of the availability of commercial infrastructures in research site showed that only 1 unit of stalls is available. Therefore, to achieve the optimal service of commercial infrastructure, the addition of 4 units of stalls is needed.

4.2. The Availability of Educational Infrastructure
Educational infrastructure is supporting infrastructure that enables students to optimally develop their knowledge, skills, and attitude with teaching-learning strategy based on the prevailing curriculum. Educational infrastructure includes basic planning, design, and implementation of school buildings, in accordance with the decision of Director General for Secondary Education, Department of Education and Culture.

Object of the study related to the performance of educational infrastructures includes: (1) preschool; (2) elementary school; (3) junior high school; (4) senior high school. The standards of the educational infrastructures above is presented in Table 2.
Table 2. Educational facilities

| Learning Facilities | Minimal number of suitable resident | Function | Location | Distance | Number of Classrooms Needed | Floor Area Required | Land Area Required |
|---------------------|-------------------------------------|----------|----------|----------|-------------------------------|---------------------|-------------------|
| Pre-Learning Level  | 1500 population where children at age of 5-6 years accounted for 8% | Accommodate the implementatioin of pre-school education of 5 or 6-year old children | Within the neighborhood / integrated with playground within the neighborhood | Calculated based on the system of elementary school education of 5-6 years using the formula (1) | 1.5 M²/Student | 125 M² | 2,500 M² |
| Elementary School   | 1600 population | Accommodate the implementatioin of primary school education | Not crossing the environment road and within the neighborhood | Calculated with formula (2) | 1.5 M²/Student | 1.5 M² | 2,000 M² |
| Junior High School  | 4800 population | Accommodate the implementatioin of junior high school | Not located at the center of the environment, able to integrate with sports field and other educational facilities. | Maximum Radius of 100 M | Calculated with formula (3) | 1.75 M²/siswa | 9000 M² |
| Senior High School  | ≥ 4800 population | Accommodate the educational implementatioin of Senior High School | Able to integrate with sports field or other educational facilities and not located at the center of the environment | Maximum radius of 3 km from the unit | Calculated with formula (4) | 1.75 M²/individual | 1. one-story senior high school for 12.500 M² 2. two-story senior high school for 8000 M² 3. three-story senior high school for 5000 M² |

Source: National Indonesian Standards [14]

Total residents of 1,152 residents, there is no obligation to build educational infrastructures in the research site. Nevertheless, educational problems of children on site can still be fulfilled with the nearest, existing educational infrastructures.

4.3. The Availability of Health Infrastructure

This infrastructure refers to infrastructure that support the health of the residents also functions to control the development and growth of the population. Object of the study related to the performance of health
infrastructures includes: (1) integrated health post; (2) clinic; (3) Maternal and Children Health Center and maternity hospital; (4) community health center; (5) physician; (6) pharmacy. Furthermore, the standards of the health infrastructures above is presented in Table 3.

**Table 3. Health facilities**

| Facilities                                      | Minimum residents served | Functions                                           | Distance                                      | Minimum space requirements               | Floor area required | Land area required |
|------------------------------------------------|--------------------------|----------------------------------------------------|-----------------------------------------------|-------------------------------------------|---------------------|--------------------|
| Integrated Health Post (Posyandu)              | 1000 residents           | Provide health services to toddlers                | Reachable within the maximum radius of 2000 M from the farthest unit and the highest floor | A room to accommodate health activities   | 30 M²               | 60 M² (KDB 50%)    |
| Clinic                                         | 1000 residents           | Provide health services to residents               | Reachable within the maximum radius of 400 M from the farthest unit and the highest floor | -                                         | 150 M²              | 300 M² (KDB 50%)  |
| Maternity and Children Health Center and maternity hospital | 10.000 residents | Provide services to mothers prenatal, natal, and postnatal and provide services to children up to six years old | Reachable within the maximum radius of 100 M from the farthest unit and the highest floor | At least two rooms are available as checking and waiting | 600 M²              | 1200 M² (KDB 50%) |
| Community Health Center                        | 30.000 residents         | Provide comprehensive health services to residents that include child specialist, dental specialist, and provide services to children up to six years old | Reachable within the maximum radius of 1000 M from the farthest unit and the highest floor | At minimum, doctor examination room, dental examination room, and waiting room are available | 350 M²              | -                  |
| Physician                                      | 5000 residents           | Provide first general/specialist health services to residents | Reachable within the maximum radius of 1000 M from the farthest unit and the highest floor | An examination room and waiting room.     | Minimum 18 M²      | -                  |
| Pharmacy                                       | 10.000 residents         | Serve residents in drugs procurements              | Reachable within the maximum radius of 1000 M from the farthest unit and the highest floor | Store room, drug formulation room, and waiting room. | Minimum 36 M        | -                  |

Source: National Indonesian Standards [14]

Total residents of 1,152 residents, the mandatory health infrastructures are integrated health post and clinic. Recordings of the availability of health infrastructures in research site showed that only health infrastructure available is 1 unit of integrated health post. Based on the standards of health infrastructure,
this amount is unable to serve the needs of residents. However, based on the same standard, there is a lack of clinic in research site. Therefore, to achieve the optimal service of health infrastructure, the addition of 1 unit of clinic is needed.

4.4. The Availability of Religious Infrastructure

Religious infrastructure is any infrastructures used to accommodate all religious activities and supporting activities of residents in research site. Object of the study related to the performance of religious infrastructures includes: (1) prayer room; (2) local mosque; (3) community mosque; (4) subdistrict mosque; (5) other religions place of worships. With total residents of 1,152 residents, the mandatory religious infrastructures is prayer room. Furthermore, the standards of the health infrastructures above is presented in Table 4.

| No. | Types of Facilities               | Suitable Number of Population | Needs For Each Unit of Facility | Standard (m²/individual) | Criteria                                                                                     |
|-----|----------------------------------|------------------------------|--------------------------------|--------------------------|---------------------------------------------------------------------------------------------|
| 1.  | Musholla/Small Mosque            | 250                          | 45 Floor area Min (m²) 100    | 0.36                     | Within the neighborhood Can be a part of the building other means Within the neighborhood Can be a part of the building other means |
| 2.  | Residential Mosque               | 2,500                        | 300 Land Area Min. (m²) 600  | 0.24                     | Within the neighborhood Not crossing the highway Able to integrate with community centers. |
| 3.  | Urban Village Mosque             | 30,000                       | 1,800 Standard (m²) 3,600    | 0.12                     | Reachable by public transportation Adjacent to the environment/urban village. As a two-storey facility, CBR 40% |
| 4.  | Sub-district Mosque              | 120,000                      | 3,600 Standard (m²) 5,400    | 0.03                     | Adjacent to the environment/urban village. As a two-storey facility, CBR 40%                |
| 5.  | Other religion's worship place   | Depend on the kinship system / hierarchy of institutions | Depend on local customs | Depend on local customs | Adjacent to the environment/urban village. As a two-storey facility, CBR 40%              |

Source: National Indonesian Standards [14]

Field observation showed that in research site only 1 mosque available and usually functioned to perform congregate Friday prayer. Therefore, there is no obligation to build prayer rooms in the research site.
4.5. The Availability of Government and Public Services Infrastructures
Government and public services infrastructure are facilities used for the benefit of public services such as security post, meeting hall, neighborhood and community association offices, security post, police post, public telephone station, multipurpose building, open space, and mail box. The standards of the government and public services infrastructures above is presented in Table 5.

**Table 5. Government and public services facilities**

| No. | Provided facilities       | Maximum number of that can have access | The location and the maximum distance from occupancy unity | Location at the building floor | The minimum floor area | Minimum floor area (Separated building) |
|-----|--------------------------|----------------------------------------|-----------------------------------------------------------|-------------------------------|------------------------|-----------------------------------------|
| 1.  | Neighborhood Office      | 250 residents                          | At the center of flats environment                       | Can be located on the occupancy floor | 18 M² – 36 M²          | -                                       |
|     |                          |                                        | Located at the center of the neighborhood and integrated with multipurpose room. |                               |                        |                                         |
| 2.  | Hamlet office            | 1000 residents                         | Located at the center of the neighborhood and integrated with multipurpose room. | Can be located on the occupancy floor | 36 M²                  | -                                       |
|     |                          |                                        | Located at the center of the neighborhood with a maximum reachable distance of 200 M |                               |                        |                                         |
| 3.  | Security Post            | 200 residents                          | Located in the front part or around the environment     | Can be located on the occupancy unit ground floor | 4 M²                  | 6 M                                     |
|     |                          |                                        |                                                                 |                               |                        |                                         |
| 4.  | Police Post              | 2000 residents                         | Located next to the other public services               | At the ground floor           | 36 M²                  | 72 M                                    |
|     |                          |                                        | Located at the center of the neighborhood with a maximum reachable distance of 500 M |                               |                        |                                         |
| 5.  | Payphone                 | 200 population                         | Located next to the other public services               | At the ground floor           | 60 x 60 cm             | -                                       |
|     |                          |                                        | Located at the center of the neighborhood with a maximum reachable distance of 500 M |                               |                        |                                         |
| 6.  | Multipurpose Building    | 10000 population                       | Located next to the other public services               | At the ground floor           | 250 M²                 | 500 M²                                  |
|     |                          |                                        | Located at the center of the neighborhood with a maximum reachable distance of 500 M |                               |                        |                                         |
| 7.  | Open Space               | 200 population                         | Can be integrated or may utilize multipurpose room      | At the ground floor           | 100 M²                 | -                                       |
|     |                          |                                        | In front of each residential building                   |                               |                        |                                         |
| 8.  | Post Office Box          | 1000 population                        | In front of each residential building                   | At the ground floor           | -                      | -                                       |

Source: National Indonesian Standards [14]
Based on the analysis of activities, with the total of residents of 1,152 residents, the mandatory government and public services infrastructures are neighborhood and community association offices, security post, public telephone station, multipurpose building, open space, and mail box. From field observation, it was found that the available public services are management office, security center, power house, and garbage bank. Whereas the public services facilities which are not available and need to be established are, neighborhood and community association office, public telephone station, multipurpose building, open space, and mail box.

Figure 4. Management office of Mariso Low-cost Apartment

Figure 5. Security post of Mariso Low-cost Apartment

Table 6. Standards of open spaces

| No. | Types of Facilities                     | Suitable Number of Population | Land Requirement Min. (M²) | Standard (m²/ individual) | Reachable Radius (M) | Location Criteria and Completion                                                                 |
|-----|----------------------------------------|------------------------------|---------------------------|---------------------------|----------------------|-------------------------------------------------------------------------------------------------|
| 1.  | Park/ Playground                       | 250                          | 250                       | 1                         | 100                  | At the center of neighborhood                                                                   |
| 2.  | Park/ Playground                       | 2,500                        | 1,250                     | 0.5                       | 1,000                | At the center of activities of the environment                                                 |
| 3.  | Park and Sports Field                  | 30,000                       | 9,000                     | 0.3                       |                      | At the center of activities of the environment, Better if integrated with educational facilities|
| 4.  | Park and Sports Field                  | 120,000                      | 24,000                    | 0.2                       |                      | Located in the main road. Better if integrated with educational facilities                     |
| 5.  | Green line Cemetery/ Public Cemetery   | -                            | -                         | 15 M                      |                      | Considering the reachable radius and the facilitated area.                                     |
| 6.  |                                        | 120,000                      |                            |                           |                      |                                                                                                |

Source: National Indonesian Standars [14]
4.6. The Availability of Open Space
The intended open space in this study is any open spaces planned with specific purpose that includes desired space quality and desired space functions. Therefore, it does not include open spaces as the remaining spaces or planned building groups. The standards of open spaces infrastructures for urban environment is presented in Table 6. Based on the analysis of activities, with the total of residents of 1,152 residents, the mandatory infrastructure in residential environment of Mariso Low-cost apartment is park/open field as social interaction facility between residents.

5. Conclusion
Mariso low-cost apartment is one of vertical housing intended for Low-Income Communities (LIC) in Makassar and is intended to fulfill the governmental duty of providing housing for citizens. Mariso low-cost apartment evaluated by Post-occupancy evaluation is to measure the performance of supporting its infrastructures of building with 10 years of occupancy. This evaluation is intended to evaluate the performance, in addition to evaluate the actual availability of infrastructures during evaluation period based on technical standards, both SNI and regulations according to the function of the building. During its operation, the decrease of performance is present in addition to other deficiency in terms of infrastructures availability based on the standards of infrastructures and facilities of urban environment. Thus, improvements and addition of supporting infrastructures are necessary to ensure the function of Mariso Low-cost apartment as housing that fulfill the sustainability of physical and non-physical activities of its residents.

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