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Low-income households sustainability based on ecological perspective at Villa Karangsari Kebumen, Indonesia

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Abstract. The research aims to examine the ecological sustainability of low-income households at Villa Karangsari. The majority of the houses have not used energy efficiently for residents, as evidenced by waste management activities, electricity, clean water energy savings, and fuel savings to reduce pollution for the housing environment. This research uses a quantitative approach via observations and questionnaires distributed to 80 respondents. Literature suggested that low-income households could be more sustainable by creating a healthy residential environment (including lighting, air circulation, greening, and pollution-free) and energy-efficient residential (at the stage of saving energy, not yet processing water and waste management). However, the result shows that the sustainability level is only at the stage of creating a healthy home environment with a score of 3,33 (good). For energy efficiency, the score is 2,99 and classified as enough. In sum, the ecological sustainability level is low because efforts to create a sustainable environment are still the residents' responsibility. This research recommends that social capital could be used to mediate the potential for adapting and being sustainable via cooperation and networking.

1. Introduction

Sustainable development is a new world agenda in the 21st century, where the main objective is to improve human life quality. The housing aspect is a point in SDG's goal number 11, namely "Sustainability Cities and Communities," which means creating cities and settlements that are inclusive, safe, resilient, and sustainable [1]. Houses are also a means to improve the quality of life and welfare of their residents. The strategic location, how well it is designed and built, and the integration with society's social and cultural environment affect daily life that will have a long-term impact on both current and future generations [2]. Sustainable housing is an essential agenda in Indonesia, especially housing development in a high population density [3]. The current challenge is how to provide affordable and sustainable housing for the survival of its residents, namely low-income households. Therefore, [4–6] in their research examined the indicators that support low-income housing's success to become sustainable housing.

In the environmental aspect, sustainable housing is supported by a reciprocal relationship between humans and their environment. Research conducted by Jennings et al. (2016) and Al Hagla et al. (2016) suggests that environmental quality plays a vital role in realizing sustainable housing [7,8]. However, the problem that is often faced is that housing projects for low-income communities are often built by prioritizing quantity aspects to overcome the backlog so that developers do not pay attention to the quality of the housing environment built [3,9,10]. This statement indicates that the



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large number of low-income housing built in locations far from the service center, not equipped with adequate facilities, and the housing units built are of substandard quality. Poor quality low-income housing construction will make the occupants unsustainable in living because they have to prepare additional costs for repairs and maintenance [11]. Unlike previous studies that discussed more on environmental indicators for sustainable low-income housing, this study is conducted to determine the extent to which low-income residents can create a sustainable living environment according to their capabilities. Villa Karangsari is one of the housing developments built to support the government program for low-income housing to reduce the housing backlog. This housing area has 3.6 hectares, located in Jemur Village, Kebumen District, Kebumen Regency, Central Java Province. As low-income housing, Villa Karangsari is in a less favorable location. Geographically, it is located in a hilly area with a gentle slope between 5-15% and located far from public facilities and public transportation. Housing is closely related to realizing a sustainable environment because a house requires vast energy, both in land acquisition, construction, and occupancy [2]. Therefore, this article's objective is to investigate the level of sustainability of low-income residents in the Villa Karangsari Housing, Kebumen, from an ecological perspective. This article consists of five sections, including an introduction, literature, method, findings and discussion, and conclusions.

Low-income people are a group of people who have limited purchasing power, so they need government support to obtain a house (Government Regulation No. 1, 2011). This research population is people working in the formal sector but has limitations in accessing commercial houses, so they need a subsidized housing credit. Low-income households' main priority in choosing a place to live is an easily accessible workplace location because, without job opportunities, they cannot fulfill their daily lives [12]. Also, low-income households are oriented towards affordable housing prices, although low-income housing is often not supported by adequate quality. The construction of affordable housing for low-income should pay attention to user needs rather than just looking at the production target [13]. In general, their locations are in marginalized environments, of substandard quality, and not equipped with adequate facilities. It has a significant impact on the level of accessibility, socio-economic opportunities, and quality of life of its residents [14,15].

Sustainable Development Goals is a development concept that seeks to ensure the fulfillment of basic needs through social activities and technology to **limit the environment's ability to meet current and future needs** [16]. There are three pillars of sustainable development: environmental, social, and economic [17], where these three aspects must be interrelated to achieve a better quality of life for the community. In general, quality of life is a concept that focuses on the general evaluation of society and the welfare of life as a whole. There are four main aspects of assessing life quality, namely physical, psychological, social relationships, and environmental quality aspects [18]. Therefore, efforts to improve the quality of life could be made through utilizing a sustainable social environment, maintaining stable economic growth, the efficient use of research, and increasing concern for the environment [19].

Factors that support creating a sustainable housing environment are resilience to disasters, efficiency in land use and compact design, efficiency in energy use, quality of adequate housing, green open space availability, and effectiveness in resource use [4]. Furthermore, these factors are also included: pollution-free environment, accessibility, and provision of adequate transportation modes and ensuring the use of appropriate and environmentally friendly building materials [16]. The efficient use of energy and resources is related to how residents behave sustainably. Meanwhile, the aspects of the residential environment's quality, the existence of green open spaces, free of pollution, and the use of environmentally friendly building materials are related to how the residential environment's carrying capacity improves the health quality of its residents. A good quality environment forms social cohesiveness and increases social capital in community groups [7].

Low-income housing cannot be sustainable unless stakeholders pay attention to ecological aspects and energy use [6]. The ecological perspective contains the reciprocal relationship between humans and their environment to achieve balance. The assessment of the sustainability of housing in environmental aspects includes qualified, healthy houses, safe, harmonious, and well planned [20].

Good environmental quality should pay attention to safe locations from hazards and disasters, pay attention to environmental health aspects, and integrate with public facilities and transportation. A healthy residential environment's characteristics include sufficient air, lighting, and distance from pollution locations [21]. Green open space is also closely related to the determinants of human health and sustainability at the environmental level [8]. Suppose low-income housing meets the principles of good environmental quality. In that case, it will improve the residents' health and quality of life, forming substantial social capital and creating the local economic potential to support welfare [22]. This concern became the focus of this article: residents' efforts to create healthy housing to support the quality of life and efficiency of energy and resources.

2. Methodology

This article uses a quantitative research approach with primary data collection sourced from distributing questionnaires and conducting field observations. The calculation of the number of research samples used refers to the Krejcie and Morgan formula, with a 95% confidence level. Based on these calculations, the number of research samples is 80 respondents divided proportionally into three neighborhood units based on the number of residents. Frequency distribution and weighting analysis are used to analyze the results. This weighting analysis shows four sustainability categories from sustainable, moderately sustainable, not yet sustainable, and unsustainable (table 1), based on the following formula (Eq. 1).

$$s = \frac{f}{n} \times 100 \% \quad (1)$$

Explanation:

S = variable x index

F = the score of the variable

N = the total score

Table 1. Index and category of sustainable housing variables.

Index	Variable Category
0,00 – 1,00	Bad: Unsustainable
1,01 – 2,00	Poor: Not yet sustainable
2,01 – 3,00	Enough: Quite sustainable
3,01 – 4,00	Good: Very sustainable

3. Results and discussion

3.1. The physical quality of Villa Karangsari Kebumen

Most of Villa Karangsari Housing residents are young families who have only been living in 3 years. These residents' characteristics are low-income household groups who work in the formal sector (civil servants, private employees, and self-employed) but have limitations in accessing proper housing. Therefore, they need a subsidized housing credit to finance houses with tenors of 10, 15, and 20 years. Villa Karangsari is dominated by small housing (types 33/63, type 37/65, and type 47/66) with the standard quality for low-income housing [23]. Its houses use permanent walls, roofs made of wood or light steel frames, equipped with electricity and clean water networks, and proper sanitation (figure 1). The infrastructure installed in the study area includes a power grid with a power of 1300 watts per household, clean water from artesian wells, and sanitation infrastructure in the form of communal septic tanks. It is also equipped with solid waste infrastructure in garbage bins and waste collection points that meet proper infrastructure standards in housing [24].

Meanwhile, the road network infrastructure and drainage network have not yet met the proper infrastructure standards. Drainage construction has not paid attention to the health aspect. The drainage system is constructed in an open system so that in several locations, the drainage is clogged with garbage and wild plants (figure 2). Also, road networks in good condition are only on the primary strategic roads. The rest of the road network outside the main road has an unpaved condition, is not equipped with road borders, and has a small road width (figure 3).



Figure 1. Housing condition at Villa Karangsari Kebumen.



Figure 2. The drainage channel clogged with garbage.



Figure 3. The local residential roads in bad condition.

3.2. *The ecological sustainability of low-income households in Villa Karangsari Kebumen*

The environment is an essential aspect of supporting society's sustainability so that it requires a reciprocal relationship between humans and their environment. Ecologically, residents' efforts to create a healthy home environment and occupant efficiency in using resources and energy are part of environmental sustainability [4,21]. In this study, healthy and proper housing is assessed based on several aspects, including adequate lighting and air circulation, greenery around the house, and free from diseases and pollution sources. Although the Villa Karangsari Housing Area is not yet supported by good environmental quality; however, in the ecological perspective, these low-income residents are classified moderately sustainable in creating a healthy residence quality. This statement is supported by evidence of residents' efforts to implement health standards, namely free from contamination or sources of diseases [16].

Figure 3 shows that as many as 92.5% of residents mentioned their house is free from diseases (mosquito larvae, dirty water puddles, and household waste pile) and pollution sources. Adequate lighting and air circulation in each house are among the health indicators related to the developer's housing quality. As many as 87.5% of residents provided good light sources and sunshine. Meanwhile, only 76.3% of residents feel their home is equipped with adequate air circulation. The greening aspect also cannot be separated from the indication of a healthy home. However, based on the existing conditions at Villa Karangsari Housing, only 72.5% of residents made efforts to do greening around their house. Several residents have not been able to create greenery around the house because of the type of shelter. Small types of dwellings, namely types 33 and 37, have a limited land area so that the developer maximizes the house lots in this residence as a built-up space. The provision of low-income housing in developing countries is prioritized to meet the quantity aspect so that low-income housing is often built below standard [14]. This condition causes the limitations of low-income residents in having sufficient green space around their dwellings. It has worsened since the developer has not planned an environmental scale greening either green lines or green open spaces, even though green open space is one of the determining factors for the resident's health [8].

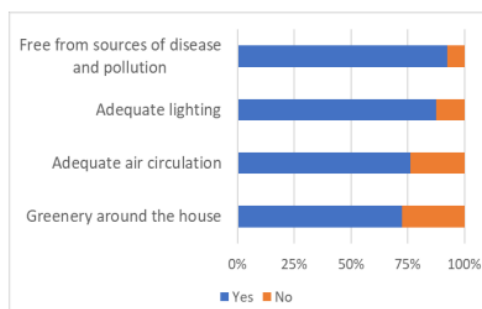


Figure 4. Low-income households efforts to create a healthy home environment

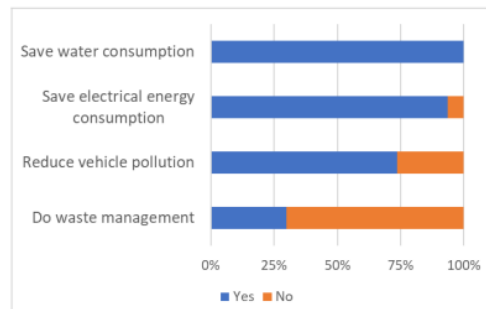


Figure 5. Low-income households' efforts to be efficient in using energy

Besides creating a healthy residential environment, ecologically sustainable residents' identification also includes their behavior in managing energy and household resources efficiently [19]. The indicators of sustainable housing in environmental aspects are the availability of proper facilities and utilities, efficient and recyclable energy use such as clean water and electricity, and an environment protected from pollution [2,4]. Figure 4 shows that all residents made efforts to save on clean water while as many as 94% of residents to save on electricity usage. The characteristic of residents in this housing is the low-income group so that the efficiency efforts are only at the stage of saving energy to reduce family expenses. As a low-income family, not all residents able to reduce motor vehicle pollution and conduct household waste management activities. Research recorded that 74% of residents tried to reduce residential motor vehicles' pollution by walking while traveling recorded neighborhood. Meanwhile, the number of residents who conducted waste management is only 30%. It can be concluded that the sustainability of the low-income residents in Villa Karangsari Housing is only at the stage of creating a healthy home environment but not yet supported by efficiency in the use of energy and resources in their daily lives (as informed in table 2).

Table 2. Ecological indicator weighing results.

Aspect	Score	Index (%)	Category
Healthy Housing	3,33	83,25	Good
Energy Efficiency	2,99	74,75	Enough

Until now, efforts to create a sustainable environment are still the personal responsibility of each resident. A good quality environment forms social cohesiveness and increases social capital in community groups [7]. This statement does not entirely reflect the existing conditions in the Villa Karangsari, as physically, it has low environmental quality. Therefore, to improve low-income housing's environmental quality, social capital needs to be supported, such as cooperation and network amongst the residents. A leadership role is also essential to organize and channel the community's aspirations for activities to improve the housing environment's quality. Therefore, both social capital and environmental quality have a reciprocal relationship to create a sustainable low-income housing environment. Sustainable housing is not destined only because of its physical quality but also because residents make efforts to live sustainably.

4. Conclusion

This research confirms that the ecological sustainability of low-income households is still at a low level. A sustainable environment is generated by a good quality environment and residents' behavior to create sustainable environment. The low-income families at Villa Karangsari are classified sustainable at the stage of creating a healthy home environment but have not been supported by energy and resource efficiency. In other words, their behavior towards energy efficiency is only at the stage of saving daily energy use. Creating a sustainable housing environment is the responsibility of each resident and the community. Results show that social capital performs as mediating potential for adapting and being sustainable via cooperation and networking. Finally, this article recommends optimizing the existing social capital for conducting environmental oriented activities, namely communal waste management, greening the communal area, and ensure that neighborhood meets health standards.

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