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To cite this article: Y A Hidayat *et al* 2020 *IOP Conf. Ser.: Earth Environ. Sci.* **447** 012033

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Social sustainability indicators for school buildings in Surabaya

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Abstract. School buildings are important for the education process. Surabaya, the second-largest city in Indonesia has many public-school buildings. As the buildings have a long project life cycle, the concept of sustainable development is relevant for this type of facility with regard to promote maximum benefit to the community. This paper aims to determine the criteria of social sustainability for the public-school buildings in Surabaya. The study first identified the variables based on literature. Then, a preliminary survey involving four experts was conducted to verify which variables should be used for the questionnaire survey. The variables were also analyzed using mean and standard deviation (SD). The study found 17 relevant indicators for measuring the social sustainability of school buildings in Surabaya. The five most relevant indicators are (1) the building is supported by users and the community; (2) the building is close to public transportation facilities; (3) the building can fulfill the needs of the local community; (4) the building can adapt to changes; and (5) the building is accessible for all people. The implementation of social aspects in construction projects is expected to deliver not only short-term, but also long-term project benefits to the community, as this aspect is closely related to community interests.

1. Introduction

School buildings play an important role as facilities where the young generation can study and socialize. Surabaya as the second-largest city in Indonesia has many public-school buildings. Specifically, based on data from the Ministry of Education and Culture, Surabaya had 168,578 public school buildings (kindergarten to high school) in 2016/2017 [1].

Construction projects provide positive benefits for the community because the constructed buildings can improve the economy and have a significant impact on the surrounding residents [2]. However, public buildings can have negative impacts if they are managed improperly, either in the construction or operations phase. Several negative effects that can happen are flooding, environmental pollution, damage to surrounding buildings, traffic congestion, and others. Thus, it is crucial to ensure that school buildings are constructed and managed appropriately so they can present as much as possible positive benefits on the community. Indeed, the community is a key project stakeholder. As such, it is essential that the decision-making process accommodates the needs and interests of the community to achieve more successful construction projects.

From the community perspective, construction projects must be sustainable, considering their long-life cycle [3] in addition to other measurements of success. The principle of sustainable development



is known as the "triple bottom line" which refers to the balance between three dimensions, namely economic, environmental, and social aspects. It is agreed that sustainability will not be achieved unless all the components can be achieved simultaneously [4]. However, unlike the other two aspects, social sustainability rarely receives attention [5]. For example, in the case of Saudi Arabia, despite trillions of dollars have been spent in the construction industry, it does not guarantee job opportunities, capacity building, or improvement of the local economy [6].

The concept of "social sustainability" is as important as economic and environmental sustainability. This aspect is closely related to community needs and interests as it ensures that projects can provide long-term benefits to stakeholders, including the community [7]. Combining social sustainability with the success criteria of the project allows success to be viewed from a community perspective [8]. Regarding the above, it is important to consider social sustainability in construction projects. This also applies to school buildings as these are abundant and these buildings usually have a long-term effect on the community. This study aims to determine the criteria for socially sustainable school buildings in Surabaya. These criteria can be used as a reference for ensuring that building projects accommodate community interests related to this type of public facility.

2. Literature review

2.1. Sustainable development

Sustainable development is defined as development that fulfills the needs of the present generation without sacrificing those of future generations [9]. The essence of sustainable development is to ensure the comprehensive implementation of the three main pillars, i.e., social, economic, and environmental [10]. Economic sustainability should ensure the long-term survival of companies in terms of financial performance and profitability while managing environmental and social aspects [11]. Furthermore, economic sustainability is the ability to meet company's direct and indirect needs without reducing its ability to meet the needs of stakeholders in the future [12].

Environmental sustainability focuses on maintaining biodiversity and natural resilience. It tends to focus directly on the health of living things rather than paying attention to financial opportunities or [13]. Natural resources and species must be preserved. Meanwhile, social sustainability is emphasized to promote and maintain a social system that embodies human dignity. This is motivated by concerns about global environmental problems or generally focuses on maintaining a human-supported environment [14]. Unfortunately, unlike the economic and the environmental dimensions which have been widely explored, the social sustainability has not been obtained a lot of attention, including in the context of construction management. Indeed, applying the social sustainability concept is crucial, especially in construction projects which has long project life cycle to achieve long-term project benefits for the wider community [7].

2.2. Social sustainability

The concept of social sustainability refers to the extent to which public facilities are safe, comfortable, provide adequate open space, are icons of pride for the community, offer equal access for all groups, and are truly supported by the community. Moreover, social sustainability is related to the collective aspect of social life as follows [15]:

- Social interaction in society
- Public participation
- Stability of the community
- Sense of belonging to a place
- Safety and security

All sustainable construction projects must abide by the highest social-ethical standards at all stages starting from planning, development, to the process of the building operations. From the perspective of social sustainability, buildings should be able to respond to human's emotional and psychological needs by providing positive stimulation to the environment, increasing awareness of the important

values of life; inspiring people; and strengthening social community behavior, and environmental relations.

Several studies have been conducted to understand how a project relates to social life because understanding and considering the social aspects of infrastructure projects is essential. For example, the concept of sustainable urban design, and critical indicators of social sustainability in urban projects in Hong Kong have been investigated [16]. This study found five key aspects of social sustainability, that are the fulfilment of the need for welfare; the conservation of resources and the environment; a harmonious environment; regulations that facilitate daily activities; and the development and availability of space. In addition, another study proposed to measure social sustainability in infrastructure projects by considering the relationship between social indicators using Social Network Analysis (SNA)[7]. Stakeholder satisfaction is vital in achieving social performance and it is often discussed as a reference in future construction projects.

Furthermore, several important factors to improve social sustainability have been examined in the context of heritage buildings [17]. This study found four main components of social sustainability, namely education and cultural promotion; the meaning of the place itself; social inclusion and psychological needs; and community participation and opportunities for skills development. Recently, the success criteria of toll roads have also been investigated from a social perspective because the toll road development strongly affects the surrounding community [8]. This study found four important factors that can be used to measure the toll road's success from a social perspective.

Social sustainability has been applied to several fields. Yet, limited research has been conducted in the context of construction management with a focus on the implementation of social sustainability for school buildings in Indonesia. Considering the importance of school buildings for the community, this research aims to investigate the social sustainability indicators for this type of public facility in Surabaya. This study is relevant because Surabaya is the second-largest city in Indonesia and has many public-school buildings.

3. Methodology

This paper is an initial step of research that aims to verify the research variables that have been identified from the literature. In this paper, the terms 'variables', 'indicators', and 'attributes' are used interchangeably. The methodology consists of variable identification, structured interviews, and analysis. Seventeen social sustainability variables were identified from literature that might be appropriate for school buildings as presented in Table 1.

Following the identification of variables, structured interviews with four experts were performed to verify the attributes that have been identified from the literature. The method of interviewing experts was selected because of its advantages over other methods. Specifically, it allows the researcher to obtain a better understanding of the existing practice of the social sustainability concept. This allows the researcher to determine the suitability of the research variables in the context of school buildings.

Table 1. Social sustainability indicators from literature.

No	Indicators	Source
1	Achieving security for the community.	[8,18,19,20]
2	The location is close to the public transport.	[16]
3	Availability of open space.	[7,16]
4	Open access for all people regardless their gender or social status.	[7,17,20]
5	Accommodating the local community needs.	[8,19,20]
6	Adaptation to local changes.	[8]
7	Tolerable pollution level (water, air, waste).	[7,17,20]
8	Involving the local community in the decision-making process in the overall building life cycles.	[17,19]
9	Providing facility for training and education.	[19,21,22]
10	Contributing to maintain the local community's values and culture.	[21]
11	Shaping the identity of the surrounding community and offering historical value.	[21]
12	Improving a sense of belonging and pride of the local community.	[8,19,20]
13	There is support of the surrounding community.	[8,20]
14	Improving the economic situation of the surrounding community (e.g. create new business activities around it).	[8,18,19]
15	Providing new jobs opportunity for the surrounding community.	[18,19,23]
16	Maintaining the community's social order.	[19,22]
17	The expectation of the construction outcomes has been communicated to the community.	[23]

Interviews were carried out with four experts from academia and the professional world. This number of experts is considered sufficient because the number of experts required to measure attributes relevancy is at least three to five [24]. This is supported by [7] who also used four experts in their preliminary survey. To calculate the relevancy of the attributes based on experts' opinions, semantic scales from 1-5 were used. Scale 1 represents very irrelevant variables where as scale 5 represents the very relevant variables. The experts who were interviewed have at least 20 years' experience in the field.

Next, the results of these interviews were used for the main questionnaire. This survey consisted of a couple of steps, i.e., determining the sample, designing the questionnaire, conducting a pilot test and distributing the questionnaire. The aim of the pilot test was to ensure that the respondents really understand the question to minimize the bias. The validity and reliability of the data that was obtained from the questionnaire were verified to check the accuracy of the questionnaire. An instrument can be considered valid if it measures what it is meant to measure or provides the results that the researcher expected. Meanwhile, a reliability test is needed to ensure that the measurement instrument is consistent in assessing the attributes [25]. Reliability is usually measured using Cronbach Alpha where an instrument can be considered reliable if this coefficient is greater than 0.60 [26]. However, the analysis of the main survey is beyond the scope of this paper.

4. Result and analysis

4.1. Attributes relevancy

The results of the preliminary survey of the experts' opinions can be represented in the form of mean and standard deviation (SD) of the attributes. Table 2 shows the relevancy and the rankings of these indicators.

Table 2. Interview survey result.

No.	Indicators	Mean	SD
13	There is support of the surrounding community.	5.00	0.00
2	The location is close to the public transport.	4.75	0.50
5	Accommodating the local community needs.	4.75	0.50
6	Adaptation to local changes.	4.50	0.58
4	Open access for all people regardless their gender or social status.	4.25	1.50
8	Involving the local community in the decision-making process in the overall building life cycles.	4.25	0.96
10	Contributing to maintain the local community's values and culture.	4.25	0.96
12	Improving a sense of belonging and pride of the local community.	4.25	0.96
1	Achieving security for the community	4.00	1.41
11	Shaping the identity of the surrounding community and offering historical value.	4.00	1.15
16	Maintaining the community's social order	4.00	0.82
9	Providing facility for training and education.	3.75	1.89
7	Tolerable pollution level (water, air, waste).	3.50	1.73
15	Providing new jobs opportunity for the surrounding community.	3.50	0.58
17	The expectation of the construction outcomes has been communicated to the community.	3.50	1.29
3	Availability of open space.	3.25	1.71
14	Improving the economic situation of the surrounding community (e.g. create new business activities around it).	3.00	0.82

Based on Table 2, the attributes' means are between 3.00 and 5.00. This study used a score of 3.00 as the cut-off to determine the attributes' relevancy as this value is the middle score between 1 and 5. As such, the paper considers attributes relevant if their mean is greater than three (≥ 3). As the overall mean of the attributes is greater than three, this paper considers all attributes relevant to be used in the main questionnaire.

4.2. Attributes ranking

In addition to the relevancy, this research also ranked the indicators based on their mean to understand the importance or significance of the indicators. The paper discusses the importance of the variables based on the existing body of literature. However, due to space limitations, only the five most relevant attributes in Table 2 are discussed. The highest-ranked attribute is "the support of the surrounding community" (mean 5.00). This attribute was considered the most relevant as the experts perceive support by the community support is essential [18]. Without this support, completing the construction process will be difficult because the community can obstruct it. Another issue is that at the planning stage, it can be decided that the building is not feasible because it has a negative impact on the community.

The second-highest ranked attribute is "the location is close to the public transport" with a mean of 4.75. This indicates that public transport is essential for community needs [16]. As such, the building location must be accessible by public transport. This can facilitate the users of the building to reach and leave the building. "Accommodating the local community needs" was ranked third with a mean of 4.75. It cannot be denied that the building has a strong influence on the surrounding area and community. Thus, its positive impacts must be maximized while the negative effects are minimized.

The fourth-ranked attribute is “Adaption to local changes”. This attribute is important as buildings have a long building life cycle. As such, they also have a long-term impact on the surrounding area. Thus, buildings must adapt to changes in the environment [17,20]. In order to do so, buildings must be designed by considering the master plan of the surrounding area before they are constructed. Indeed, a good design plays a key role in achieving social sustainability in the construction project [27].

Finally, the fifth-ranked indicator is “open access for all people regardless their gender or social status”. This is an essential measure of social sustainability to ensure that the concept of equality is applied to public infrastructure. However, the study found three more indicators with the same score, i.e., “Involving the local community in the decision-making process in the overall building life cycles” [17, 19]; “contributing to maintain the local community’s values and culture” [21]; and “improving a sense of belonging and pride of the local community [8,19,20].

In promoting more successful school buildings, applying the above social sustainability indicators can ensure the community will benefit. Indeed, as an important project stakeholder, the satisfaction of the community is vital [29]. Accommodating their needs and interest in the project decision-making can increase the success of the project [8]. Conversely, failure to accommodate the community interest can potentially lead to stakeholder opposition and subsequently reduce the chance of success of the project [30].

5. Conclusion and implications

This paper presented an overview of indicators of social sustainability for school buildings in Surabaya. The analysis using mean value based on experts’ opinions found that all 17 indicators identified from the literature are relevant for measuring the social sustainability of school buildings in Surabaya. The paper also determined the five most relevant attributes based on experts’ opinion, i.e., (1) There is support of the surrounding community; (2) The location is close to the public transport; (3) Accommodating the local community needs; (4) Adaption to local changes; and (5) Open access for all people regardless their gender or social status.

This study provides an understanding of the indicators of socially sustainable school buildings in Surabaya. These indicators are an important reference for delivering social benefits to the stakeholders, in this case, the nearby community. The implementation of the concept of sustainability is important in ensuring a balance between the economic, environmental, and social aspects of sustainability. Consequently, this balance will ensure the delivery of as many benefits as possible to stakeholders and more successful infrastructure projects. However, this paper is an initial step. Future research involves experts’ opinions regarding the verification of the variables. Further work will also be conducted to validate this result by involving a larger number of stakeholders as respondents.

Acknowledgment

The authors want to thank the Ministry of Research, Technology and Higher Education for providing the grant to perform this research. We also appreciate the experts who were involved in the preliminary survey.

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