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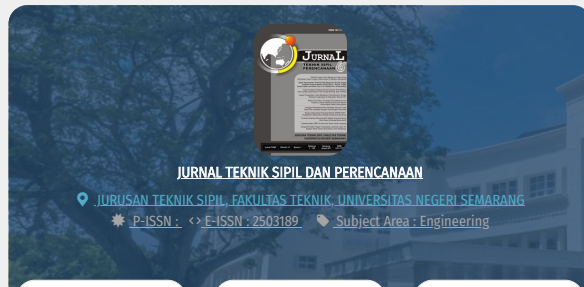
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Table of Contents

Articles

Sustainable Rural Tourism Meaning for Community Livelihood



0

DOI 10.15294/jtsp.v23i2.29320 Abstract 339 times PDF 272 times

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PDF

83 - 93



The Pattern of Settlement Distribution in Disaster Prone Areas of Semarang City



0

DOI 10.15294/jtsp.v23i2.30292 Abstract 200 times PDF 172 times

Chindy Dhia Tsabit N⁽¹⁾, Bitta Pigawati⁽²⁾,

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PDF

94 - 103



Utilization of Soybeans as Bio-Catalyst in Calcite Precipitation Method for Repairing Cracks in Concrete



0

DOI 10.15294/jtsp.v23i2.31834 Abstract 192 times PDF 141 times

Rama Zaky Rahmawan⁽¹⁾, Muhammad Fauzan⁽²⁾, Heriansyah Putra⁽³⁾,

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PDF

104 - 113



Evaluation of Building Vulnerability to Earthquake Using Rapid Visual Screening (RVS) Method



0

DOI 10.15294/jtsp.v23i2.31399 Abstract 234 times PDF 190 times

Andhika Ronald Dwi Pratama⁽¹⁾, Jajok Widodo Soetjipto⁽²⁾, Krisnamurti Krisnamurti⁽³⁾,

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PDF

114 - 124



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Understanding Civil Engineering and Architectural Engineering Students' Perceptions about BIM Practices



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PDF

125 - 133

Heni Fitriani⁽¹⁾, Audrey Fitri Yanti⁽²⁾, Mona Foralisa⁽³⁾, Ahmad Muhtarom⁽⁴⁾,

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School Safe Route in Sumbersari District, Jember Regency



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PDF

134 - 146

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Papercrete and Recipanel as Wall Material: An Environmental Sustainability Review



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147 - 156

Annisa Widya Pangestika⁽¹⁾, Ova Candra Dewi⁽²⁾, Nisrina Dewi Salsabila⁽³⁾,

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157 -

166

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Analysis of Effective Location of Shear Wall for High Rise Building with U – Configuration



1

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167 - 176

Sekar Mentari⁽¹⁾, Rosi Nursani⁽²⁾,

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Sustainable Rural Tourism Meaning for Community Livelihood

Santy Paulla Dewi^{1,a)}, Novia Sari Ristanti^{1,b)}

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Abstract. The Sangiran is a national tourism strategic area as well as the most important ancient site established by UNESCO. Hence, its existence can contribute to the community livelihood which is dominated as poor. Meanwhile, having World Heritage Sites (WHS) status gives many restrictions to the local community such as restriction to soil excavation. Focusing on the agricultural sector as their main job was relatively difficult because of the physical aspect. The community chose the possible way to gain income that the job did not relate with tourism activity. Therefore, this study examines the meaning of sustainable rural tourism for community livelihood using the sustainable livelihood approach. Two rounds of Focus Group Discussions and interviews with some experts were conducted to find out issues in the development of Sangiran tourism and stakeholder perceptions. The community considered that they could not rely on the tourism sector so that they adjusted to the situation by doing another job. Indeed, the WHS status of Sangiran had not given impacts on the community; they prefer to conduct their previous activities. The development of rural tourism was not sustained; the community was still vulnerable that pointed out by their low economic capacity.

Keywords: sustainable rural tourism, community livelihood, world heritage site

INTRODUCTION

Tourism is a strategy for poverty alleviation, including in rural areas, by developing employment opportunities, encouraging small and micro enterprises, and improving environmental quality by providing better infrastructure [1]–[3]. Rural tourism enriches economic development previously dominated by agricultural activities, yet various new economic activities emerge. Rural tourism development is because agricultural activities are no longer profitable for the community [4]. However, rural tourism development has positive and negative implications for the community and the neighborhood [3], [5]. Increasing job creation, enhancing rural community quality of life and welfare are the positive implications, whereas the negative implications such as displacement of local communities [3], disruption of local lifestyle, and environmental impact [5], [6].

Sustainable rural tourism, which is part of sustainable tourism, develops to address the negative implications of rural tourism development. Sustainable rural tourism is defined as a concept of tourism development that satisfies the visitors and gives economic benefits for the local community, whereas still a concern to the environmental preservation now and in the future [7]. Furthermore, sustainable rural tourism also implies cultural and heritage preservation tools [7], [8]. The World Tourism Organization defines sustainable rural tourism as an effort to develop tourism by utilizing its current potential but still paying attention to environmental balance and increasing opportunities for further development in the future. Furthermore, UNWTO stated that there are six principles to realize sustainable rural tourism, such as



Utilization of Soybeans as Bio-Catalyst in Calcite Precipitation Method for Repairing Cracks in Concrete

Rama Zaky Rahmawan^{1, a)}, Muhammad Fauzan^{1, b)}, and Heriansyah Putra^{1, c)}

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Abstract. Concrete is a material that has high compressive strength. However, concrete has a lower tensile strength than its compressive strength. As a result, the concrete often cracks and allows the entry of harmful substances such as Cl^- dan SO_4^{2-} causing corrosion of the reinforcement. Therefore, the repair method began to shift from the conventional way to the concept of self-healing concrete which involves the deposition of $CaCO_3$. Precipitation can be done by the enzymatically – induced carbonate precipitation (EICP) method through a combination of urease, urea, and $CaCl_2$ into a solution. This research used soybean extract as a substitute for pure urease enzyme. Variations in the concentration of soybean flour used as injection solution were variations in the content of soybean flour 15 g/L because it produced an optimum calcite mass of 2.62 grams. As a result, there was an increase in the compressive strength of BI against BR. In addition, there was a decreased value of permeability and porosity and the number of injections carried out. The increase in compressive strength, decrease in permeability, and decrease in porosity in concrete is due to $CaCO_3$ deposition in the concrete which can cover the pores and cracks in the concrete.

Keywords: Concrete; $CaCO_3$; Compressive strength; Permeability; Porosity

INTRODUCTION

Concrete is a building material that has a high compressive strength [1]. However, concrete also has limitations such as tensile strength, which is lower than its compressive strength, which is only around 9%-15% of compressive force, so concrete is brittle. Therefore, cracks in the concrete structure cannot be avoided [2,3]. This matter can accelerate the corrosion of steel reinforcement and damage to the concrete, thereby shortening the life of the concrete [4]. In addition, hazardous substances such as Cl^- and SO_4^{2-} can enter through the cracks even if the damages are minor [5]. Cracks in concrete result in decreased strength and durability, and the cost of repairs is quite expensive. Even in the UK, maintenance, and repairs in the construction sector cost £40 billion [6].

Conventional repair methods began to shift along with the development of concrete technology with a self-healing function, which is expected to solve these problems so that the topic of self-healing has become popular in recent years [7]. "Self-healing concrete" refers to a material that can recover its original properties after being degraded. Concrete by itself has autogenous healing properties due to continuous mineral hydration and deposition [8].

Precipitation of calcium carbonate ($CaCO_3$) can be done by the enzyme – induced carbonate precipitation (EICP). The precipitation occurs due to the influence of enzyme induction so that carbonate ions can be formed. Yasuhara et al. combined urease, urea, and calcium chloride ($CaCl_2$) into a solution and proved to be able to precipitate $CaCO_3$ [9]. However, the use of urease in the EICP method turned out to be less economical due to the high price of urease, especially if its use on a large scale can reach >90% of



Evaluation of Building Vulnerability to Earthquake Using Rapid Visual Screening (RVS) Method

Andhika Ronald Dwi Pratama^{1,a)}, Jojok Widodo Soetjipto^{1,b)}, Krisnamurti^{1,c)}

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Abstract. Indonesia is one of the countries prone to earthquakes. One of the earthquake disasters that occurred several years ago hit Palu and Donggala on September 28, 2018. It caused severe damage to infrastructure. Therefore, it is necessary to evaluate buildings vulnerable to earthquakes as a form of prevention. One of the buildings in Jember, the dr. Soebandi hospital, experienced cracks in the walls during an earthquake measuring 6.0 on the Richter scale in Nusa Dua Bali on July 16, 2019. This study carried out the risk assessment of the vulnerability of buildings to earthquakes using the Rapid Visual Screening (RVS) method from FEMA P-154. RVS is a method to identify a building that is potentially vulnerable to earthquake hazards based on visual observations from the exterior and interior of the building. The results of the evaluation using the RVS method showed that the dr. Soebandi hospital is categorized as safe and not prone to earthquakes, with a potential vulnerability percentage of 0.0126%. Based on these results, the building does not require special treatment to anticipate earthquakes; however, maintaining the occupants' safety and extending the building's life requires routine maintenance.

Keywords: earthquake, vulnerability, rapid visual screening, assessment, maintenance

INTRODUCTION

Indonesia is prone to earthquakes because Indonesia is an area where three tectonic plates meet, namely the Eurasian plate, the Indo-Australian plate, and the Pacific plate [1]. One of the earthquake disasters that occurred several years ago was the earthquake that happened in Palu and Donggala on September 28, 2018. According to data from the National Disaster Management Agency (BNPB), the Palu and Donggala earthquakes caused damage to 68,451 houses, 327 houses of worship, 265 schools, 78 office buildings, 362 shops, seven bridges, 168 road cracks, and so on [2]. It shows that only few planned infrastructures are earthquake resistant, and there is a lack of data on buildings prone to earthquakes. Therefore, it is necessary to evaluate buildings that are vulnerable to earthquakes as a form of prevention.

Many studies anticipate the collapse of infrastructure. Based on the literature and previous researchers, research on construction reliability can be done technically and in detail. Visually to support the initial assessment/screening of infrastructure that requires further handling have done. The study of material failure analysis by testing the relationship between steel and concrete materials has been carried out [3]. Research of the train speed limitation due to the vibration of the steel bridge construction to keep the structure from collapsing has also been carried out [4]. Analysis of building reliability uses the technical procedure for guidelines for the certificate of eligibility for the function of buildings regulation of the minister of public work to maintain structural reliability values [5] and inspections to interpret building reliability [6]. Research on the resistance of steel buildings to earthquakes uses a Fuzzy-TOPSIS method to make priority decisions based on the level of damage [7]. In addition, structural performance analysis using FEMA P-58 was carried out [8]. However, these studies require a lot of resources and require time in



Understanding Civil Engineering and Architectural Engineering Students' Perceptions about BIM Practices

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Abstract: The use of BIM within construction industry is experiencing development. However, the development of BIM in Indonesia is still very limited. One of the inhibiting factors in the development of BIM is the inadequate availability of BIM specialists and professionals in the construction industry so that an active role of students is needed as the main target in meeting the needs of the construction industry in Indonesia. This research was conducted to analyze the perceptions of students of the Sriwijaya University in the civil engineering and architecture study programs regarding perceptions of knowledge, benefits, adoption, and development of BIM. This study used a quantitative approach. Data collection was carried out using a questionnaire. It was stated that 'BIM technology and concepts are important for students to learn' was to be the highest rank with an average score of 4.70 for Civil Engineering and 4.56 for architecture students. The result shows that the benefits of BIM that influence the most in the construction industry are to improve the quality of construction and enhance design visualization. The most significant driving factor on the development and adoption of BIM is education and training on using BIM software. In addition, the most significant inhibiting factors that influence the development and adoption of BIM are lack of education or training on the use of BIM and lack of knowledge on how to implement BIM software.

Keywords: Building Information Modeling (BIM), civil engineering, architecture, construction industry, perception

INTRODUCTION

Construction technology is at a development stage with rapid progress. One of the technologies in the Architecture, Engineering and Construction (AEC) sector that is developing and has quite a lot of enthusiasts in the world is Building Information Modeling (BIM). BIM is defined as a digital representation of 3D modeling that could facilitate a precise modeling of a building system [1]. The concept of BIM is not just a software technology, but also as a holistic process that represents the attribute of a building component [2]. Based on the Regulation of the Minister of Public Works and Public Housing No. 22/2018 concerning State Building Construction [3], the buildings with an area of more than 2,000 m² are required to use BIM. It is evident that the government has contributed to the development of technological innovation in the world of construction.

The benefits of using BIM in construction projects as a means of communication among stakeholders [4]. The results showed that BIM can be effectively used as a means of communication among stakeholders to improve collaboration and information sharing. A study of [5] highlighted the use of BIM at the design stage. It was found that BIM software enabled the architect and engineer to modify building components during modeling which eventually can help the owners for decision making related to incurred costs and work progress. Mieslenna and Wibowo [6] studied the application of BIM in the Indonesian construction industry based on the user's perspective. The results showed that the benefits of BIM were to control the

Sustainable Rural Tourism Meaning for Community Livelihood

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1 Sustainable Rural Tourism Meaning for Community Livelihood

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1
Abstract. The Sangiran is a national tourism strategic area as well as the most important ancient site established by UNESCO. Hence, its existence can contribute to the community livelihood which is dominated as poor. Meanwhile, having World Heritage Sites (WHS) status gives many restrictions to the local community such as restriction to soil excavation. Focusing on the agricultural sector as their main job was relatively difficult because of the physical aspect. The community chose the possible way to gain income that the job did not relate with tourism activity. Therefore, this study examines the meaning of sustainable rural tourism for community livelihood using the sustainable livelihood approach. Two rounds of Focus Group Discussions and interviews with some experts were conducted to find out issues in the development of Sangiran tourism and stakeholder perceptions. The community considered that they could not rely on the tourism sector so that they adjusted to the situation by doing another job. Indeed, the WHS status of Sangiran had not given impacts on the community; they prefer to conduct their previous activities. The development of rural tourism was not sustained; the community was still vulnerable that pointed out by their low economic capacity.

Keywords: sustainable rural tourism, community livelihood, world heritage site

INTRODUCTION

16
Tourism is a strategy for poverty alleviation, including in rural areas, by developing employment opportunities, encouraging small and micro enterprises, and improving environmental quality by providing better infrastructure [1]–[3]. Rural tourism enriches economic development previously dominated by agricultural activities, yet various new economic activities emerge. Rural tourism development is because agricultural activities are no longer profitable for the community [4]. However, rural tourism development has positive and negative implications for the community and the neighborhood [3], [5]. Increasing job creation, enhancing rural community quality of life and welfare are the positive implications, whereas the negative implications such as displacement of local communities [3], disruption of local lifestyle, and environmental impact [5], [6].

4
Sustainable rural tourism, which is part of sustainable tourism, develops to address the negative implications of rural tourism development. Sustainable rural tourism is defined as a concept of tourism development that satisfies the visitors and gives economic benefits for the local community, whereas still a concern to the environmental preservation now and in the future [7]. Furthermore, sustainable rural tourism also implies cultural and heritage preservation tools [7], [8]. The World Tourism Organization defines sustainable rural tourism as an effort to develop tourism by utilizing its current potential but still paying attention to environmental balance and increasing opportunities for further development in the future. Furthermore, UNWTO stated that there are six principles to realize sustainable rural tourism, such as

meeting the satisfaction of visitors and community, optimally utilizing natural resources, respecting the local culture in the local community, providing social-economic benefits to all stakeholders, periodic monitoring processes on implementation and possible impacts of tourism development, and participation of all stakeholders [9].

In the sustainable development context, culture and heritage preservation need the government's commitments to register its assets as UNESCO World Heritage Sites (WHS). A tourism site that includes a WHS has many implications [10], [11]. Enhancing tourism attractiveness, controlling land use, and mitigating sprawl are several positive implications of WHS [11], [12], whereas negative implications are the destructive impact on the environment and loss of local values [11], [13]. Moreover, the government should address some consequences such as maintenance costs, emphasizing the tourism development policy. Hence, WHS requires comprehensive, consistent efforts and support from all stakeholders. Indeed, in developing sustainable rural tourism, community participation is prioritized [14].

The local community is an important actor in rural tourism development and the preservation of WHS. Because of the existence of WHS, it will affect the community's livelihoods, social characteristics, and others [15]. Therefore, as a primary actor in developing rural tourism and WHS preservation, the government needs to consider the community as a partner. It is a formidable challenge because the rural community tends to be more conventional, rely on productive agriculture, and face poverty.

A similar situation has also been identified in the Sangiran, one of WHS in Indonesia. Sangiran is the largest and most important ancient human site in the world designated by UNESCO since 1966 [16], located in Krikilan Village, Sragen Regency, Central Java Province, Indonesia. Based on Government Regulation No.5 of 2011 concerning the National Tourism Development Master Plan (RIPPARNAS), the Krikilan cluster includes one of the National Tourism Strategic Areas, so its management is the central government's authority. The Central Java Province government has also been involved, mainly in local community empowerment, while the Sragen regency government provides and manages infrastructure. The Sangiran Museum has an essential role in developing science and as a tourism site on a national as well as international scale.

Since established as WHS in 1996, the Sangiran development as a tourist attraction has been less significant. The government has developed since 2009 after the formation of the Sangiran Ancient Man Site Preservation Center. The local community responds to the government's efforts on the Sangiran development positively. The increasing number of people who switch jobs from agriculture to tourism represented the community's enthusiasm. However, the visitors' number was only 1 % of the number of visitors in Central Java, making it hard for the tourism business actors. The number of stone artisans remains three craftsmen from the 50 craftsmen, and others chose to work as construction workers (their previous job before running a tourism business). Hence, it implies that the inclusion of Sangiran as WHS cannot attract visitors. A similar situation has also been found in China's world heritage inscriptions because of many restrictions enacted [15].

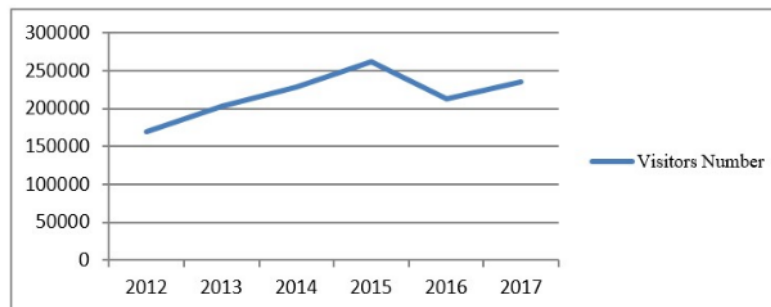


FIGURE 1. Number of Visitors Sangiran Museum

Previously, the Sangiran existence influenced the local community, both in the tourism and non-tourism fields. People who work in the tourism field were starting to switch jobs to a non-tourism job; the number of homestays began to decrease; and some people who tried to develop the other new tourist attractions which are not directly related to Sangiran as WHS. Whereas people who work in the non-tourism field, especially agriculture, stand in a dilemmatic position, the soil type is not suitable for agriculture activities, while soil excavation has also been banned. The presence of the Sangiran Museum has not been able to overcome poverty. The data showed that 34.6% of Kalijambe Subdistrict people classify as poor who primarily work as farmers or laborers. Eventually, some people chose to work to find fossil stones by digging and then selling them to

intermediaries. On the contrary, Law number 11 of 2010 concerning Cultural Heritage states cultural heritage objects protections; a restriction to soil digging to look for the fossil; this fossil excavation is regulated by law.

Sustainable rural tourism development is not easy; the local community and visitors exploit natural resources excessively [17]. Because of the community's disobedience and the predominance of economic reasons, they pay little attention to environmental aspects in practice. Discussion on rural tourism in several studies recently emphasize how rural tourism role on the poverty alleviation [18], which is also related to the entrepreneurship of the rural community [19]. Community's capacity on developing a business related to their skills and innovation which very much difficult for them. Hence, rural poverty is still found in some tourism site areas. Therefore, this paper aims to answer to what extent sustainable rural tourism means for the community livelihood primarily related to the Sangiran as WHS.

DESCRIPTION OF STUDY AREA

Sangiran site is relatively close to Surakarta (14 Km) and 10 Km from Adi Sumarmo international airport. Sangiran, as one of the world's research sites on the history of ancient human existence. Stratigraphically and archaeologically, the soil layers at the Sangiran Site are arranged in sequence without interruption from 2 million years ago to around 200,000 years ago. They were the complete ancient human site in Asia in the form of animal fossils, and ancient humans 2 million years old ever live on the island of Java. Sangiran is a unique, attractive, and rare tourist destination. This museum is the head office of Sangiran Early Man Site Management Center (Balai Pengelola Situs Manusia Purba Sangiran-BPSMPS) under the Ministry of Education and Culture.

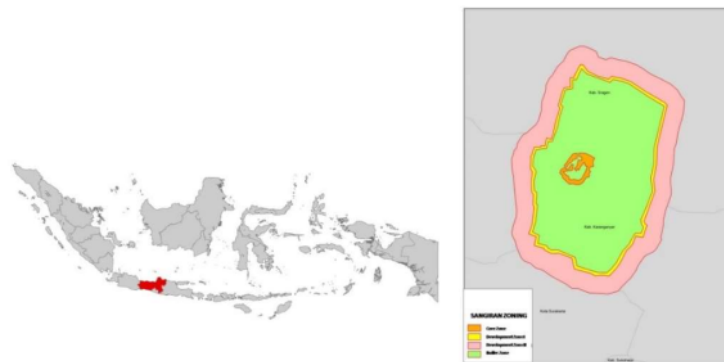


FIGURE 2. Sangiran Zoning

Around Sangiran, there are some folk craft groups, including stone-souvenir artisans, woven bamboo artisans, coconut-button crafters, wooden furniture artisans, and batik artisans. There was no tourism awareness group so that counseling about tourism development has never been done. The lack of professional staff managing tourist attractions, especially Ngebung, Bukuran, and Manyarejo Clusters, has caused various obstacles. Sangiran has an area of 59.21² km with four development zones divided as follows:

- a) The Core Area, an absolute zone with an area of 57.41² km
- b) The buffer zone, which is an area outside the Sangiran site, must be maintained to support the existence of the site with a radius of 100 meters outside the core area

The Development Zone, a development zone with limits of utilization, still refers to world heritage rules. This zone is divided into two, namely Development Zone I covering an area of 1.80 km², and Development Zone II with a radius of 1 km outside the buffer zone.

To improve education and tourism aspects in Sangiran, the Ministry of Education and Culture built five museum clusters on the site with an area of approximately 59.21 km² as follows:

1. **Krikilan Cluster Museum** is the largest and has the most collection among the four other museums, and it locates in Krikilan Village, Kalijambe District, Sragen Regency.

2. **Ngebung Cluster Museum**, located in Sragen Regency, provides information on fossils for alternative medicine in ancient times, especially in China. The depiction is equipped with an exciting diorama and touch screen monitor.
3. **Manyarejo Cluster Museum**, the most exciting spot is the excavation display. Through this display, visitors can see pieces of soil made during excavation activities.
4. **Bukuran Cluster Museum** has the most modern display that reveals the theory of evolution, extinction, the emergence of new species, biodiversity, adaptation processes.
5. **Dayu Cluster Museum**, located in Karanganyar Regency, is about 2 km from the Krikilan Cluster Museum.

The Sangiran Museum held tens of thousands of fossils from the Pleistocene era more than two million years ago. As many as 65 % of Indonesian fossil findings are in Sangiran. The fossil findings in the form of ancient hominids (allegedly as the origin of human evolution) as many as 50 species or individuals and constitute 50 % of fossil findings in the world. In Sangiran, there are more than 13,685 fossils, of which 2,931 are in the museum and the rest in the storage. The difference between the Sangiran site and other sites is that there are records of human and environmental footprints in the 250,000 to 2 million years old layer of soil. Some collections from the Sangiran museum include human fossils, vertebrate human fossils, aquatic animal fossils, rocks, and stone tools.

There are three exhibition rooms of the Sangiran Museum. Exhibition Room 1 shows the various findings and research by G.H.R. Von Koenigswald and other foreign researchers. Whereas the exhibition Room 2 contains sequences of human life, ranging from ancient humans to modern humans with audiovisuals about the natural occurrence, the exhibition Room 3 contains a replica statue of Homo Erectus human life, various ancient animals, both land animals and sea animals such as ancient elephants, crocodiles, buffalo, fish, crabs.

MATERIAL AND METHOD

The qualitative method's research seeks to explore further issues related to tourism development and its contribution to society. The expected outcome is poverty reduction in the community through tourism development.

Data Needs

Data collected related to local community perceptions about Sangiran's existence as a tourist attraction and WHS through interviews with community leaders, community, and souvenir merchants. The selection of informants from community leaders is based on several criteria such as the native Krikilan Village, knowing the village's development, and the community before and after Sangiran listed as WHS. Besides, two rounds of Focus Group Discussion (FGD) were also carried out to find out more comprehensive tourism development by involving Research and Development Planning Agency, Tourism Office, Public Works Office, Education and Culture Office, Agriculture Office, and community group concerned with tourism development. The FGD held two rounds; the first round aimed to understand the issues, problems, and challenges related to tourism development in Sragen Regency, while the second round FGD held to find out the stakeholder perception Sangiran development. Furthermore, this research needs several data that can be seen in Table 1.

TABLE 1 Research Data

No	Data	Aim	Source
1	<ul style="list-style-type: none"> - Local community occupation - The influence of the Sangiran site on the community livelihood - The village development in terms of tourism context; infrastructures provision, land use 	<ul style="list-style-type: none"> - Identify the local community characteristics - Identify the village development 	Interview to the community leader
2	<ul style="list-style-type: none"> - The Sangiran's impact on the community livelihood - Local community's preference regarding the tourism development - Problems that arise along with the tourism development 	Identify the local community perception of the Sangiran development	Interview to the local community

No	Data	Aim	Source
3	<ul style="list-style-type: none"> - The Sangiran's impact on the local community's income - Souvenir merchant's perception related to the Sangiran development - Problems for souvenir merchants along with the tourism development 	Identify the souvenir merchant's perception regarding the Sangiran development	Interview the souvenir merchant that stays in Sangiran for at least ten years
4	<ul style="list-style-type: none"> - Government programs to empower the local community - Local community involvement in government activities 	Identify the community participation in the tourism development Identify the benefit that gains from the Sangiran development	Research and Development Planning Agency, Tourism Office, Public Works Office, Education and Culture Office, Agriculture Office

In addition, this study has also used secondary data obtained from some government institutions such as the Statistic Agency of Sragen Regency to get demographic data and the Ministry of Education and Culture website to collect data about government efforts related to Sangiran development.

METHODOLOGY

Understanding the community's livelihood requires a comprehensive study not only in economic aspects but also in social aspects. Therefore, this study uses the Livelihood Approach method or commonly known as the Sustainable Livelihood Approach. This method is considered able to explain the local community's perceptions and conditions, especially in rural areas, as well as how their relationship with the surrounding environment [20]. The livelihood definition is the local community's effort to fulfill its daily activities and income. Moreover, livelihood has also referred to the local community's means to respond and survive in difficult situations; the presence or absence of alternative occupation, difficulties in generating income [3]. Sustainable livelihood can be achieved when the local community survives from shocks and stresses that arise from the tourism development and the more empowered. These two aspects are the two main ideas in sustainable rural tourism [20].

In this study, the correlation between sustainable rural tourism with sustainable livelihood is shown by local community involvement in tourism development and how people address the problems because the development of Sangiran as one of the less desirable tourist destinations, farming on barren land conditions, and water scarcity, and limitations education and skills. Furthermore, it also illustrates how the local community seeks to overcome difficulties with its existing capital. Hence, the existence of Sangiran as one of the tourist destinations is not only able to satisfy visitors but also contributes to the economic generation of the local community so that tourism development can be said to be sustainable.

RESULT AND DISCUSSION

Analysis of Livelihood Resources

The analysis of livelihood resources is reviewed from natural, physical, human, social, and financial aspects. These five aspects are related to each other; the aspect of natural capital affects the type of community occupation (in this case is financial). Likewise, human and social aspects (quality of human resources) in the educational background have also affected the financial aspects.

TABLE 2. Community's Livelihood Resource

No	Capital	Variable	Analysis
1.	Natural	Paddy-field type	100% (64 ha) is rain-fed rice fields, which means the rice field production depends on the rainfall. The existing situation shows that Krikilan has relatively low rainfall (107 mm/year) so that the irrigation can not support rice cultivation. Hence, the farmers

No	Capital	Variable	Analysis
			only have harvest once per year. They can harvest rice twice per year if the rainy season is longer than the dry season.
		Soil type	The soil type is regosol, requiring much water to be more productive. This soil type is more suitable for planting crops or plants that are not greedy for water instead of rice that requires sufficient irrigation.
		Disaster-prone	Krikilan includes medium-level disaster-prone areas, especially land movements. It is indicated by the cracks and land subsidence in residential areas.
2.	Physical	Housing type	There are three classifications of community houses in Krikilan; the first is permanent (a house that has permanent foundations, poles, roofs, and walls using appropriate materials) which reached 62.8 % of the community residing in this house type. Second, semi-permanent houses utilize semi-permanent walls or roofs (28.3%). Third, board houses (tenements) occupy 7.9 % of the community, and bamboo houses are inhabited by 1 % of the community.
3.	Human	Population number by sex	The population composition is almost general, whereas the number of women is 51%, men number is 49%.
		Population number by age	The population of productive age (15-65 years) dominates (67%). It implies that the labor potential is quite large
		Number of family members	On average, one household consist of-3-4 persons in a house
4.	Social	Education level	68.6% of the Krikilan community completed compulsory education (complete junior high school), the remaining 1.7% is graduated from universities, and 12.6% belonged to the illiterate group.
5.	Economic	Occupation	51.9% of residents work as farmers, both as agricultural landowners and as agricultural laborers. While the population who work in tourism-related fields is relatively low, while 11.6% community's occupation as traders, both souvenir traders and traders of daily necessities, and services (8.5%)
		Livelihood level	48.4% of the Krikilan community includes a prosperous family I, which means a family that can meet the basic needs but has not met social-psychological needs such as education, transportation, and interaction with the environment. Meanwhile, 38.5% of the community belongs to prosperous families II; families who can fulfill their basic needs but do not have any savings, do recreation and have the opportunity to increase their capacity. Prosperous II families have a higher economic level than prosperous families I. The remaining (13%) is including pre-prosperous families where are families who can not meet their basic needs such as clothing, food, shelter, spiritual

The identification of the community's livelihood resources implies that their capital is still relatively low. The most potential is only in physical resources where the local community's houses included in the permanent house category can be used as capital to enter the tourism development activities; they can run homestay for visitors. However, having low financial capacity makes the provision of homestays a modest category. For instance, they do not provide adequate facilities, relatively narrow rooms, not yet equipped with wifi, and air conditioning. At present, there are six homestays with an average of 2-6 rooms for rent. It is only one homestay that offers 16 rental rooms. The average homestay rental price is 100,000 - 300,000 rupiahs (USD 7.3-22) per day, with a relatively low occupancy rate (only 20% each month). Besides, guests' length of stay is relatively short, which is averaging one day only. Furthermore, if we search from an online hotel and inn search engine, it will be directed to the inn or hotel in Solo city, approximately 17 km from Krikilan. It implies that having homestay is not yet a strategic business that is potential and promising; this homestay business is only a side job because of income uncertainty.

The highest number of the population age is 15-19 years (12%), which means that this age group starts looking for a job. It implies that the employment number is relatively high, yet the skill level is low, categorized as laborers because they do not have special skills. The community's education level matters and influence the skill capacity that mostly they graduated from elementary school. Then, the occupation option is limited. Likewise, the community livelihood that represents the local community's occupation is

dominated by people who work in the agriculture field, while the tourism sector (included as services category) is still low.

Hence, all capital, natural, physical, human, and social, leads to economic capital. Krikilan village's local community is not entirely out of poverty, indicated by the existence of underprivileged families. Having low resources makes the community need government assistance to be involved in tourism development through interventions and programs. In sustainable rural tourism, community participation is necessary as tourism actors and as actors who conserve the environment [14]. Some government programs enhance the community's capacity and expertise through conducting various training and courses.

Analysis of Adaptive Strategy

This analysis examines the local community's efforts to survive and meet their daily needs, where many restrictions must obey. Ranging from relatively barren soil types that are less fertile for planting, irrigation systems that still rely on rainwater, low levels of education and skills, and a restriction on land cultivation it can disrupt the fossil exploration

There are two types of farmers in Krikilan; farmers who own rice fields and farm laborers and people who work for the rice field owners. The farmers start their activity to plant rice at the beginning of the rainy season (October). The rice field irrigation is a rain-fed rice field so that during the dry season, the rice fields do not supply water. Hence, during the dry season (April-September), many rice fields are left unplanted. Because of the hilly land condition, prone to landslides, and barren, it is not potential as agricultural land. Therefore, most farmers can only harvest rice once a year, which is in January. If the rainy season is relatively longer occur (until June), the farmers can plant rice twice a year. However, this is quite risky, especially when there is a season change. Rice plants that lack water can cause crop failure, and farmers can suffer losses of up to 70 quintals/ha (17.5 million rupiahs). The significant loss risk is the most consideration for farmers to determine the plant types that are not greedy for water, such as yams and soybeans.

On the other hand, the people who work as farm laborers have no option when the rice field owners choose to unplanted. They have to shift their occupation to construction workers in other cities like Solo, Jakarta, and Surabaya. Becoming a construction worker is a farmworker who chooses to stay in the Krikilan. Construction workers who work in Solo will be had round-trip travel; from Sragen to Solo and back to Sragen every day and earn 100,000 rupiahs (USD 7.3) per day with a distance of 30 km, while workers who work in Jakarta and Surabaya will go back to Sragen in 1-2 months and earn 150,000-200,000 rupiahs (USD 11-14.6) per day. They will return to their homes during the rice planting season, and after the planting season ends, they work as a farm laborer again. Likewise, during the harvest season, they will return to the village and work as farm laborers. It is because there will be much work done during the planting season and the rice harvest season. Therefore, they will be paid higher than usual. Their wages are 100,000-150,000 rupiahs (USD 7.3-11) with for working from 5 - 11 AM, get free lunch for male farm laborers, and for women, farmworkers to be paid 40,000-50,000 rupiahs (USD 2-3) with 6 hours of work and get a free lunch. Likewise, during the dry season, many paddy owners do not cultivate their land as well as rice field owners who plant their land with crops, the work does not need much, so the wages of farm laborers decrease (35,000 rupiahs (USD 2.5) per 6 hours and get a free lunch).

As an international tourist attraction, Sangiran has not significantly affected the farmers' livelihood. In 2012, when neither the planting season nor the rice harvest season, farm laborers tried to work as stone craftsmen who made souvenirs for selling to visitors. In 2012, the central government and the government of Central Java Province started to conduct socialization and training activities such as the development of homestay businesses, training of stone crafts, and other small businesses training (batik, food preparations) to support Sangiran tourism. However, these efforts did not sustain (ended in 2013) because the job was considered less profitable because of the lack of visitors. Hence, they turned into construction workers, whereas the rice field owners have other businesses such as raising livestock like goats, cows, or chickens.

Some local communities have also worked as fossil stone seekers, looking for this fossil stone around the Cemoro River and doing it manually. The local community often refers to the original stone from Sangiran as a beautiful philosopher's stone. The stone is considered sacred because, since discovering fossils around Sangiran, the local community believed that the stones or bones have a magical power that can cure disease. The stone characteristics are relatively light, not too hard, and have plant motifs. This fossil stone is sold to artisans to be formed into accessories such as bracelets, rings, key chains, prayer beads, and home decoration. Both stone handicraft and stone business owners know how to choose good quality stones. The buyers of these handicrafts come from several cities such as Jakarta, Bandung, Bogor Sumatra, and overseas buyers from Malaysia and America. These buyers are usually preferred to order marble stone that is processed into tables and other home decorations. The selling price of marble stuff is relatively high, reaching 5 million rupiahs (around USD 400), depending on the type of stone used and the

item's size. If the craftsmen and stone business owners only rely on the business to sell souvenirs for tourists, it will not be enough to meet the needs. Souvenir prices vary from the cheapest 10,000 to hundreds of thousands of rupiah (USD 7 - 35). Moreover, the presence of stone handicrafts from the Chinese that sell at a lower price than local artisans significantly influences the local handicraft income.

It means that the presence of Sangiran has not affected increasing revenue. However, only the big name of Sangiran that gives benefits for them because many buyers from other countries are looking for stone-based handicraft items will go directly to Sangiran. Moreover, the proximity to raw materials (in this case, fossil stones) makes stone artisans can get raw materials more easily at relatively lower prices.

The stone craftsman opened a souvenir shop around the Sangiran Museum that also as their home. Currently, there are seven souvenir shops located on Jalan Sangiran. Besides processing and selling fossil stones, they also sell oxidant stones, crystal stones, calcite stones, coral stones, sapphires, and others. The stone craftsman was assisted by a stone carver who originally came from the same village, another village, or even another city. The migration of villagers due to decreased agricultural productivity and lack of employment opportunities in Krikilan is also found in other rural areas in general [21]. Tourism development is another option that can improve the community's economy by exploiting the local resources, local culture, traditional food, and the beauty of rural nature. However, tourism development in Krikilan has not been able to move the regional economy, so people have switched to other conventional fields of work.

The communities have a high enthusiasm regarding tourism development; they were willing to switch their occupation from industrial workers to tourism-related jobs. They prefer to live with their families in Krikilan, even though they earn less money than work out of town with a slightly higher wage. Nevertheless, the current condition shows that the tourism-related job can not be considered the primary source of income, so being a laborer remains a priority for them.

The government's role in developing tourism and improving the community's economy can be seen from several programs that have been implemented. First, the government's village funds programs aim to increase infrastructure provision to support tourism, such as launching a tourism village program, repairing village roads, forming a Tourism Awareness Group, and supporting local culture such as the *gejog lesung* attraction (community's traditional performance). However, the amount of village funds is still limited, so that it has not significantly contributed to increasing community capacity. The role of the Klaten district government also focuses on improving infrastructure, particularly district roads, which are the primary access to Sangiran. Road improvement had only 10% of all damaged roads due to the district government's limited fiscal capacity. As a result, the direct access to the Sangiran area is still poor with bumpy road conditions and deer. Meanwhile, the Central Java provincial government's role emphasizes community empowerment by providing training such as homestay management training and developing MSMEs that support tourism development. However, due to the lack of assistance to these business actors, the results have not been optimal. On the other hand, the relatively small number of Sangiran visitors is considered less promising for the community to depend on tourism.

Sustainable Rural Tourism meaning for Community Livelihood

Sangiran has been known since the 18th century when the discovery of fossils began. The community lived with fossils in their neighborhood. Fossils with a size large are considered giving prosperity and luck to the people who found and kept them. Besides, it was also believed that these fossils had the power to cure various diseases. Therefore, people do not need to take this fossil out, except for health purposes. However, this belief began to change when Koenigswald asked people to collect fossils because they have economic and historical value. Then, people began to look for and collect fossils to be traded until now, and the local community's trust in taking fossils will soon recover.

The buying and selling of fossils stones continue. For the Krikilan village community, the most important thing is the fulfillment of economic aspects, how their income is sufficient to meet their needs. Illegal soil excavation is still carried out even though there is a ban on it. Agriculture (rice planting) is the only activity allowed by the government.

"I sell the stone to craftsmen. I did not give the fossil to the museum because I know the museum has already collected small pieces of stone and left them lying. Therefore, I think this stone did not have much meaning so that I sell it." (the stone seeker)

Hence, Sangiran's status as a national tourism priority area and WHS does not affect the community occupation. The role of tourism activities as an economic development generator has an insignificant impact. The community's enthusiasm for tourism development decreased along with the decline of the Sangiran visitors' number. The result of many courses conducted by the Central Java Provincial government

did not give a significant outcome. It was caused by no government assistance after the community finished the course, the limitation of capital for business development makes people look for other ways to gain money.

2 The challenge of developing rural tourism in Indonesia is the need for cooperation and community involvement in tourism development [22]. The development of rural tourism is very complex, especially with Sangiran's status that involves multi-stakeholders. If participation and empowerment are not optimal, tourism development is also not optimal. In the Sangiran context, efforts to illegally excavate land and buy and sell fossils will damage the site. Quoted from Doxey, in Caust and Vecco, 2017, the local community's attitude towards tourism development consists of four stages: euphoria, apathy, annoyance, and antagonism. If it is associated with existing conditions, the first three stages have been passed by the Sangiran community.

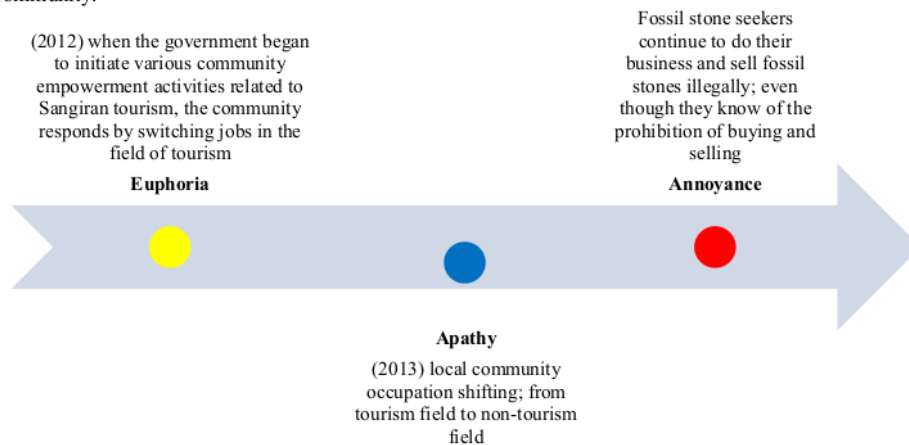


FIGURE 3. The attitude of Sangiran's Local Community towards Tourism Development

The exploration of natural resources implies that the community does not consider the natural balance and historical value. It also indicates that the livelihood community level includes unsustainable; the consumption of the natural resources surges and ignores future needs [22]. The stone craftsmen use the raw material for the philosopher's stone, which incidentally comes from Sangiran, and use other stone raw materials obtained from other cities. However, it is not indicated that there has been an attempt to substitute raw materials from the magic stone to be another stone type. Stone seekers are still looking for and selling beautiful philosopher's stones; Hence, this stone's exploration continues even though there are other raw materials used.

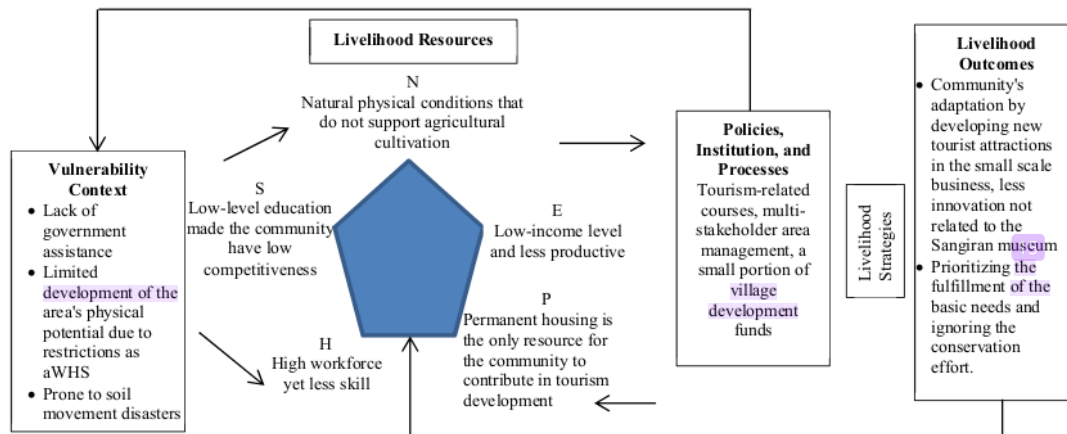


FIGURE 4. Sustainable Livelihood in Krikilan

The Krikilan community adapts to tourism developments because relying on agriculture is difficult. Hence, the community and local governments continue to explore the existing potential. One of them is through the development of salt springs and *punden tingkir*. However, limited funding and support from the district government have delayed efforts to develop this potential.

CONCLUSION

The existence of WHS shapes the community's livelihood. Some previous studies mentioned that WHS would give positively and negatively affect the local community and its environment. This study concluded that the status of WHS affected the local community in the first step of development tourism only, whereas the community's enthusiasm declined gradually along with the less tourism implication to their income. It can be seen from the type of local community's occupation is relatively the same, before and after Sangiran determined as a WHS. They still work as a farmer and a farm laborer. Likewise, the number of underprivileged populations is also still high, so poverty still becomes the main problem. Hence, the community's adaptive strategies by developing other new economic activities (non-tourism). The community livelihood is considered unsustainable because it is still emphasized on financial fulfillment, so it often clashes with other aspects, especially nature.

There is a shift in the meaning of Sangiran, especially the existence of fossils on the community livelihood; from something that is saved, sacred, and they take the fossils for specific purposes so that the community indirectly participates in preserving the existence of these fossils into something that can generate money so that it is traded. Shifting of Sangiran as a tourism attraction and as a WHS meaningful for community livelihood is influenced by the development of Sangiran itself, such as promotional activities, improvement of supporting facilities, which will ultimately increase visitors' number. If, currently, Sangiran has provided economic benefits to the community through the sale and purchase of fossils, then with the further development of tourism, it is expected that Sangiran can provide economic benefits in a more positive context.

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