Innovation in application of green infrastructure for rural development

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Abstract. This paper explains the innovation in village development through the integration of green infrastructure development and local culture. In the rural development discourse, culture is explained as a factor that is able to bring solidarity and a shared desire in encouraging rural development. Much research describes innovation but examines the green development and local culture separately. This study aims to explore how the application of green development in the village with its cultural uniqueness as an innovation for environmental sustainability. In order to understand the complexity, we used a qualitative research in a single case study approach and applying an in-depth interview with the key informants. Then, the qualitative content analysis method is used by studying and analyzing communication systematically and objectively to the messages. We found that the culture behind the implementation of green development. The material and process of building cultural infrastructure emphasize the preservation of the surrounding natural environment. This innovation survives as an effort to preserve the environment and develops as an educational and cultural tourist attraction in rural development. Thus, environmental sustainability is able to realize by innovating in infrastructure development that is integrated with the culture of the community.

1. Introduction

In many studies, culture is explained as factors that are able to hinder innovation in rural development. In a social setting, a culture is often used to represent rules, values, and expected behavior of the community that governs people's daily life [1–4]. Culture are able to bring solidarity and a shared desire to encourage development, but the values, norms or rules of that culture tend to limit the application or creation of innovation in development [5–8]. In addition, studies on culture in green infrastructure development are limited. Thus, the studies that examine both green development and culture can grow the literature on environmental sustainability and rural development.

A culture is created from values that are trusted and internalized in daily life so that it becomes a belief in the community. In addition, the values of the culture become an identity and uniqueness in the society. A culture can shape the economic sense as well as an important role in improving the welfare of the community. As Michael McPherson argues, which is quoted by Chavoshbashi et.al [9] that the economic development is a culture process because of the economics itself. The values and cultural norms that exist between the individuals and their economic activities are the rural development potentials [8,10]. Therefore, this study investigates innovation in rural development, especially green infrastructure development in traditional village.
In this study, we explained the application of green infrastructure as an innovation by the traditional village community, cultural integration in infrastructure development and its influence on environmental sustainability and village development. Generally, we found that the culture behind the development of green infrastructure in which green infrastructure is meant is the use and recycling of natural resources used for development [11–13]. In the context of the rural development, the integration of cultural values and the development of green infrastructure can be an attraction for educational tourism. The infrastructure can be enjoyed as a tourist attraction as well as the knowledge and values in it can provide experiences as well as learning for the tourists. Furthermore, this innovation is able to create the socio-economic opportunities for the rural development.

2. Methods

In order to examine innovation in green infrastructure development, we employed qualitative research methods through an empirical study. We used a qualitative research in order to understand the complexity of the phenomena that highlight the innovation process and its influence on environmental sustainability and village development. We also conducted an in-depth interview with the key informants getting involved in the innovation process and leaders in the village. They were 9 (nine) key informants and were selected based on the criteria. We used Lamajang Village, Pangalengan District, Bandung Regency, Indonesia as our case study. The community in this village preserve their culture and use it for an education tourism. The variables used in the interviews are local knowledge, the social-economics activities, village infrastructure, innovation product and process, and environmental sustainability. We used the qualitative content analysis method in order to study and analyze the communication systematically and objectively by paying attention to the context [14]. In the process, we first sorted and coded the relevant data. Then we reassembled the data which involved choices, such as scoring the existing quotes, building hierarchical relationships and designing a matrix. In this step, we compiled the interview citations and then search for the meanings contained in the message or text and interpreted these. Furthermore, we formulated conclusions based on patterns found in the data [15]. In order to prevent the bias from the personal opinions, we conducted three procedures in the analysis process, i.e., making constant comparisons between different key informants, observing and restructuring findings that initially seemed similar but did not fit in the flow of analysis, and lastly, looking for the alternative explanations for initial observations [16].

3. Result and discussion

The Lamajang Village is located in Pangalengan District which is the agglomeration for tourist objects and attractions in Bandung Regency, especially in natural tourism. The Lamajang Village is a rural area. The physical characteristics of Lamajang village are the highlands and hills which dominated mostly by agriculture. The Lamajang Village is known as a traditional village in Bandung Regency, Indonesia. This village’s culture has been preserved by its community for 360 years. Since 2011, this village has been designated as a cultural tourism village in Bandung Regency by the local government and it has been promoted to the national level through the Ministry of Tourism. The object and attraction of cultural tourism in the village that is well known is Kampung Adat Cikondang. This paper will be more explore the cultural infrastructure in Kampung Adat Cikondang and its culture in environmental preservation.

Innovation may answer challenges of sustainability, in that efficiency leaps prove the crucial role of innovation in sustainability [10]. Innovation in rural development that is integrated with culture might able to lead to the creation of new socio-economic activities for the local community. The following discussion we explained the application of green infrastructure as an innovation by the traditional village community, cultural integration in infrastructure development and its influence on environmental sustainability and village development.
3.1. The application of green infrastructure development in a traditional village

Traditional villages applied green infrastructure in the construction of their traditional houses as can be seen in Figure 1. We found that the culture behind the development of green infrastructure in which green infrastructure is meant is the use and recycling of natural resources used for development [11–13]. In Lamajang Village, especially in Kampung Adat Cikondang, building materials for traditional houses come from natural resources or trees that the community planted and maintain themselves in the area around the traditional house, which they call a prohibited forest area. Building materials and the process of building custom homes are governed by norms that are believed and maintained by the community. These norms contain religious values that lead to environmental sustainability.

![Figure 1. The traditional house in Lamajang Village.](image)

The Cikondang Traditional House Site is aged more than 200 years old. Historically, there was a fire in 1942 in the traditional village of Cikondang, which only 1 house remaining. The house is guarded by its authenticity by the family as a proof of history and the existence of a culture that has long existed in this village. This traditional house underwent two renovations due to the old building materials. This renovation was carried out by the family and also government’s assistance where the renovation may not change the shape or size of the traditional house. In addition, the building materials also utilize the woods from Hutan Larangan. This forest belongs to an indigenous family which is overgrown with the rare agarwood trees in West Java. Historically, this forest is a place to store heirlooms, a place of discussion of the propagators of Islam, a hiding place from the Dutch invaders and a hiding place for war at that time. The forest is maintained by the family and may not be sold, both land and plants in it.

3.2. Culture in green infrastructure development

Knowledge and experience of the community are the basis of the construction of infrastructure that promotes environmental sustainability. We found that the culture does not only originate from the local knowledge but it will develop as the community experiences grow over time while it also holds a religious value. The local knowledge is passed on from the ancestors to their descendants or to whom have a biological family relation. The knowledge is written in a book that is guarded by the guardians of value who is chosen by the community through deliberations with certain prerequisites and rules. The knowledge about the history and philosophy of the cultural materials exist in Kampung Adat Cikodang, such as the prohibited forests, the traditional house, and the heirlooms. Moreover, the knowledge is about provision in Kampung Adat Cikondang such as procedures for land and natural resources management and architectural provision of traditional houses. The knowledge is passed down and it is a mandatory for the oldest male descendants in the family to obey, nurture and communicate the knowledge to those who come to the customary village. Over time, the knowledge continues to be shared so that it becomes a part of people's lives. The communities receive and believe this knowledge as something valuable and that it needs to be preserved as a cultural product for the development of their village.

The culture also develops from the experience of the community. The experience of the tourist in Kampung Adat area makes the knowledge and values much strongly believed by the community and
becomes a part of people's life. For example, there are residents or tourists who already know the methods and rules that must be obeyed in the Kampung Adat area, but they violate them, then they get a bad experience for their actions. This condition is an experience as well as a new knowledge for the community. The local knowledge is gained by the behavior actualization in accordance to that knowledge. The more community see the consequences from the local knowledge violation action in the Kampung Adat area, the more it gives them beliefs, especially for the local people to live and behave accordingly to the local knowledge or culture that is inherited from their ancestors.

We found that the local knowledge contains a lot of Islamic values. This knowledge is developed along with the process of spreading Islam by their ancestors in the past. At that time, the spread of Islam was carried out clandestinely so that in the process, the knowledge is also interacted with the existing knowledge in the community. One of the example of islamic values in the local knowledge is the existence of the architectural rules of traditional houses that have five windows, which shows the amount of time of prayer in Islam.

In addition, the community also has norms that lead to environmental preservation, including the existence of four celebrations called traditional rituals which must be carried out in this village for a year. These rituals are the ritual which carried out at the end and beginning of the Hijr year (Muharram) called Wuku Tawun, the ritual in the middle of the village is called Hajat Lembur, and the water ritual is called Hajat Solokan and Hajat Paralon. Each celebration contains values that are believed by the community. For example, the ritual Wuku Tawun is performed by the community as a form of gratitude to God who has given crops that can revive the community throughout the year. It also aims to welcome the Islamic New Year and ask for protection and safety within the next year. The norms and rules represent the guidelines for how people should behave and how they treat others which are formed by a shared ideas and beliefs about what is morally right or wrong, or what is culturally desirable [7].

In sum up, culture is the basis of the construction of infrastructure that promotes environmental sustainability. Culture consist of the local knowledge that is inherited from a generation to generation and also from the community experiences that are part of village life. In addition, the local knowledge and the experience contains Islamic values, which are influenced by the history of the spread of Islam at that time. The culture of Islamic values is also unique to this village. All of them are the culture preserved by the local community until now which has become the uniqueness of the village and it has potentials for development.

3.3. The role of innovation in environmental sustainability and rural development
In The Lamajang Village, the cultural norms are encouraged to increase the local interaction and create an interaction between the local communities and the external parties. It is also can be used in order to maintain the close relationships in the society, and also introduce the culture to the next generation. The annual celebration is held by involving all local resources such as agricultural products, energy and money from the community voluntarily. Those things become the norm that applies in the society. The cultural activity is involving around 800 people from various backgrounds, both local people and external parties. The food is cooked by the communities using traditional concoctions. In addition, there is also a ceremonial purification of heirlooms which can only be done by the family. The local culture is the object and tourist attraction that invites tourists to watch and get firsthand experience. These conditions can drive the local community's economy.

Meanwhile, we found that there was an interaction between the local people and external parties, such as universities, researchers, tourists, journalists, and the government, which helped strengthen the existence of the local culture. There were an exchange of information and learning processes from these interactions. This interaction generates the ideas about the concept of a cultural education tourism which combines the local knowledge and community needs. The concept was created from the idea of preserving the community's culture by utilizing the local knowledge as the uniqueness and tourist attraction. This has become a potential used by the community and the government to develop the village. The economic opportunities increase with the increasing interaction between the local people and external parties. This can be seen by the emergence of stalls around the traditional villages which
are open until the evening. Moreover, several residents' homes also become homestays for tourists and the emergence of local transportation which is called Ojek to serve the tourists. Until now, there are still many local and regional tourists who visit the traditional villages with the aim of learning or promoting the local culture.

4. Conclusion
The integration of green infrastructure development with culture leads to innovation in environmental sustainability and rural development. The innovation is able to lead to the creation of new socio-economic activities for the rural community [10]. The material and process of building cultural infrastructure emphasize the preservation of the surrounding natural environment. This innovation survives as an effort to preserve the environment and develops as an educational and cultural tourist attraction in rural development. Thus, environmental sustainability is able to realize by innovating in infrastructure development that is integrated with the culture of the community. A culture is formed from the local knowledge which is inherited from the descendants and also the experiences of the community. The knowledge is developed and also influenced by the history and development of the village community [3,17,18]. This knowledge and experience become the basis for the formation of the norms and rules for the livelihoods of the rural communities. Further, this culture becomes a value or principle in green infrastructure development [11]. The infrastructure can be enjoyed as a tourist attraction as well as the knowledge and values in it can provide experiences as well as learning for the tourists. This condition is able to create an economic opportunity for the rural development.

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