

RESEARCH ARTICLE

Bridging Isolation or Breaking Nature? Community Perception on Road Development in a Conservation Area

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ABSTRACT

Infrastructure development in conservation areas is a double-edged sword, offering potential socio-economic benefits while posing environmental risks. This study examines community perceptions of the construction of a parallel road in Tanjung Lokang Village, located within the Betung Kerihun National Park, Indonesia. The research utilized a survey method involving 65 households across two hamlets, Tanjung Lokang and Bu'ung, through interviews and observations. Data were analyzed using descriptive qualitative techniques. The results revealed that community perceptions vary across social, economic, and environmental aspects. Socially, most residents in Tanjung Lokang view the road positively, citing improved mobility, technology access, education, and healthcare. However, respondents in Bu'ung Hamlet expressed less enthusiasm due to limited physical access to the road. Economically, both hamlets anticipated significant benefits, including increased income, market access, and business opportunities. In contrast, environmental perceptions were mixed. While some community members acknowledged the road's potential to support eco-tourism and environmental services, others expressed concern over forest disturbance, biodiversity loss, and deforestation due to increased land use and shifting cultivation. The findings emphasize the importance of inclusive planning and empowerment initiatives to mitigate negative environmental impacts while optimizing community welfare. A balanced development approach is crucial to align local aspirations with conservation objectives.

1. Introduction

Community infrastructure development plays a critical role in enhancing the quality of life and improving the mobility of people and goods, contributing significantly to overall community welfare. Recognizing this, the Indonesian government has prioritized infrastructure expansion, particularly in the context of improving road accessibility in the so-called 3T regions: *tertinggal* (disadvantaged), *terluar* (outermost), and *terpencil* (remote). Expanding road access in these areas aims to stimulate socio-economic activities, foster regional integration, and reduce development disparities (Agustina et al. 2023; Alam et al. 2024). However, the process of road infrastructure development must be approached holistically, considering not only economic and technical feasibility but also social and cultural dimensions, especially community involvement and local support. Community participation is essential, as local populations are not only the intended beneficiaries of such projects but also the most directly affected by their implementation, potentially serving as active participants, implementers, or critics of the development process (Sofiaton 2023). For instance, the Trans Papua Road project has sparked significant controversy due to its predominantly economic-centric implementation model, which contrasts sharply with the worldview of Indigenous Papuans (*Orang Asli Papua/OAP*). OAP communities maintain a deep-rooted environmental and spiritual relationship with their land and view large-scale infrastructure projects through an ecological and cultural lens (Kambu et al. 2022). This

disconnect has contributed to social tension and resistance, underscoring the urgent need for culturally sensitive and inclusive development frameworks that align state objectives with Indigenous values and environmental stewardship. Aligning the trade-off between negative impacts on the environment and the benefits of roads for the community is challenging. Road construction in remote, outermost, and frontier areas in developing countries, including Indonesia, will increase the effectiveness of agricultural extension services and the application of better agricultural technology, increase school participation, improve market access by reducing transportation costs, and shift households from agriculture to service-based jobs (Aggarwal 2018; Khandker et al. 2009; Mu and van de Walle 2011; Rammelt and Leung 2017). Roads will provide access to markets, schools, health care, and opportunities to exchange information, electricity, and clean water services (Hettige 2006; Jacoby 2000).

Perception is interpretation, which is the ability of an individual to differentiate, classify, and focus on something. (Qiong 2017) states that the process consists of selection, compilation stage, and interpretation. The selection stage receives part of the information obtained. The compilation stage is grouping information into meaningful patterns. The interpretation stage requires giving meaning to the stimulus received. Each individual's perception tends to be different because of the various interpretations of the stimulus (Qiong 2017). Public perception of parallel road construction activities is related to the understanding and views of each individual. In Bloom's taxonomy, understanding lies in the cognitive realm or the ability to understand something. If they know it well, people will accept the concept of edu-agrotourism (Masyrroh 2020). Meanwhile, views are defined as opinions in the big Indonesian dictionary. A person's view will develop through imagination and stories about the environment, and this view will influence their interpretation of the environment and determine behavior. Communities with a positive view of something tend to support the development of urban forests (Formen et al. 2012).

Good public perception and views regarding the construction of parallel roads are needed to create functional, aesthetic, and environmentally friendly effects of conservation areas (Adzkie and Fatimah 2020). Understanding community perceptions and support is critical to the success of this development (Formen et al. 2012). Conservation areas are inseparable from residents living in the area, which so far tend to be inaccessible to development activities. The construction of parallel roads will open inaccessibility to various other development accesses. This research is important to explain the public's perception of the development that will be carried out in their area and to determine further policies due to the impact of the construction of parallel roads. Perceptions that will be seen from social, economic, and environmental aspects become basic data for further development activities so that there is a balance between responding to the socio-economic needs of the community on the one hand and conservation needs on the other. The research aims to explain public perceptions regarding the construction of parallel roads and the impacts on the community and the Betung Kerihun National Park (*Taman Nasional Betung Kerihun/TNBK*) area.

2. Material and Methods

2.1. Study Area

The research was conducted in Tanjung Lokang Village, Kapuas Hulu Regency, a village in the TNBK area affected by the construction of parallel roads. **Fig. 1** shows a map of Tanjung Lokang Village.

2.2. Research Design

Data was collected on settlements in the administrative area of Tanjung Lokang Village, which borders/intersects with the TNBK area, for 30 working days. Data were taken in the form of primary data and secondary data. Determination of respondents using accidental sampling with an intensity of at least 10% of the total number of households per village (Juanda 2009). This study's respondents were 43 households in Tanjung Lokang Hamlet, or 40% of the total households in the hamlet (a total of 120 households), and 22 households in Bu'ung Hamlet, or 50% of the total heads of families in the hamlet (45 households). Data collection for this study was also carried out by collecting data and information from key informants in the village administrative area. The key informants are community leaders such as village officials and traditional leaders.

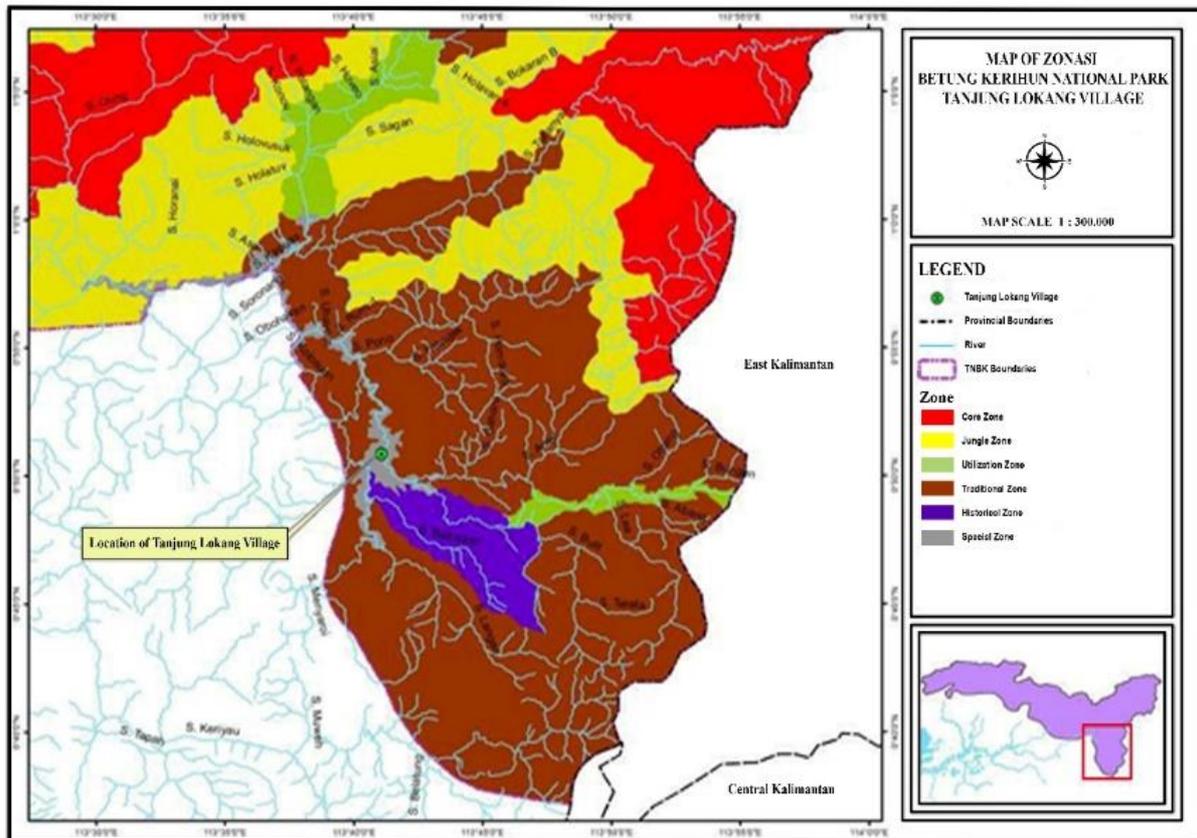


Fig. 1. Research location.

Data was collected using a questionnaire through open and closed questions (Guttman Scale). The social data contains questions about community perceptions and current conditions related to social situations, social interactions, participation, conflicts, and changes in norms/rules, culture, and customs due to road construction in forest areas. Meanwhile, economic data contains questions about community perceptions and current conditions related to livelihoods, income, business opportunities, job opportunities, expenditures, market access, and community skills that occur due to road construction in forest areas.

Data collection was carried out at direct/ongoing meetings at locations that had been carried out, as well as the results of the implementation of community socio-economic study activities in the work area of the Section Region IV Nanga Era, TNBK area. Threats consist of logging, Non-Timber Forest Product (NTFP) collection, hunting, and natural disasters (fallen trees, landslides, etc.) that were found and were occurring at the time of data collection. Data was collected on potential threats in direct encounters/signs, for example, logging, NTFP collection, hunting, and natural disasters (fallen trees, landslides, etc.). The data above are part of environmental data and are needed to support data on social and economic conditions in the community. In this study, environmental data were also collected directly from the community using a questionnaire. Environmental data contains questions about community perceptions and current conditions related to the impact of road construction on environmental conditions, such as disturbances to forests and the environment, pollution, and biodiversity.

The analysis method used in this study examines all data obtained from various sources, both direct interviews, field observations, personal documentation (audio recording or manual note-taking), and official documents. Descriptive analysis techniques describe the object of research based on the facts that appear as they are.

3. Results and Discussion

3.1. Results

The research findings reveal that several perceptions come from social, economic, and ecological aspects. **Table 1** provides a detailed perception of social aspects; meanwhile, economic aspects can be seen in **Table 2**, and **Table 3** provides the perception of environmental aspects.

Table 1. Community perception for the social aspect

No.	Parameter	Tanjung Lokang		Bu'ung	
		Agree (%)	Not Agree (%)	Agree (%)	Not Agree (%)
1	Increasing community togetherness	91	9	100	0
2	Supporting mutual cooperation activities for village communities	95	5	91	9
3	Communities participate in planning parallel road construction	98	2	0	100
4	Communities participate in the parallel road construction process	77	23	0	100
5	Community involvement in road construction is going well	91	9	0	100
6	Making it easier for people to enter and exit the village	100	0	32	68
7	Supporting increased population migration	95	5	86	14
8	Supporting increased community education levels	98	2	95	5
9	Supporting increased community health	100	0	95	5
10	Supporting increased technology in the village	100	0	95	5
11	Supporting increased information flow in the village	100	0	95	5
12	Will not change prevailing norms in the village	95	5	100	0
13	Does not interfere with the existence of sacred places in the village	100	0	100	0
14	Helping the community to perform traditional rituals	100	0	82	18
15	Supporting the community to maintain traditional medicine	72	28	0	100

Table 2. Community perception for the economic aspect

No.	Parameter	Tanjung Lokang		Bu'ung	
		Agree (%)	Not agree (%)	Agree (%)	Not agree (%)
1	Beneficial for the family economy	100	0	100	0
2	Increase community income in the village	100	0	91	9
3	Improve community livelihoods in the village	100	0	95	5
4	Increase community spending in the village	21	79	45	55
5	Make it easier for people to sell agricultural products	100	0	95	5
6	Improve transportation access to the market	100	0	91	9
7	Improve health infrastructure	100	0	91	9
8	Improve education infrastructure	100	0	91	9
9	Increase the desire to buy motorized vehicles	100	0	100	0
10	Increase the desire to start a business	91	9	100	0
11	Community empowerment is beneficial for the community's economy	91	9	100	0

3.2. Discussion

This study draws on several interrelated theoretical approaches to comprehensively examine the interplay between infrastructure development and its social, economic, and environmental impacts, particularly in indigenous and conservation areas. First, the Political Ecology framework is employed to understand how power relations, governance structures, and economic interests shape environmental decision-making and resource access. Political ecology highlights how infrastructure projects, such as road development, are not purely technical undertakings but are deeply embedded in social and political contexts that can marginalize local voices, especially those of Indigenous communities. Second, the study incorporates Cultural Ecology, which emphasizes the relationship between human communities and their natural environments, particularly how traditional knowledge systems and cultural practices influence land use and conservation. This perspective is essential in analyzing the worldview of a community in the conservation area whose connection to the land is spiritual, communal, and ecologically grounded. Finally, the research adopts elements of Participatory Development Theory, which advocates for the active involvement of local communities in the planning, implementation, and evaluation of development projects. This approach underlines the importance of community agency, empowerment, and social inclusion, especially in contexts where local populations are the most directly affected by environmental change. Together, these theoretical lenses provide a robust foundation for evaluating the complex social dynamics, ecological implications, and ethical considerations inherent in road development projects in sensitive areas like conservation.

Table 3. Community perception of the environmental aspect

No.	Parameter	Tanjung Lokang		Bu'ung	
		Agree (%)	Not Agree (%)	Agree (%)	Not Agree (%)
1	The community wants to open land/work on the land	91	9	100	0
2	The community wants to do activities on parallel roads	86	14	100	0
3	Causes forest disturbances due to fires and logging	2	98	100	0
4	Causes flooding and erosion	53	51	0	100
5	Causes a decrease in water quality	2	98	0	100
6	Causes a decrease in air quality	0	100	0	100
7	Causes a decrease in soil quality/fertility	0	100	0	100
8	Increase commitment to preserving animals and plants	77	23	0	100
9	Increase the potential for nature tourism	100	0	82	18
10	Support the sustainability of environmental services	93	7	100	0
11	Support the sustainability of protected wildlife	79	21	0	100
12	Support the sustainability of protected plants	84	16	0	100

3.2.1. Social aspect

In the social aspect, it is known that the construction of parallel roads has increased community togetherness in Tanjung Lokang Village and also supports mutual cooperation activities for village communities so that village community activities in both Tanjung Lokang Hamlet and Bu'ung Hamlet are better and smoother. Community togetherness in Tanjung Lokang Hamlet is reflected in farming activities such as opening fields, planting, and harvesting. Community togetherness is also reflected in daily life in the village. However, concerning the construction of parallel roads, community involvement in Bu'ung Hamlet, both in planning and community participation in the development process, is not involved. This is influenced because the administrative center of Tanjung Lokang Village is located in

Tanjung Lokang Hamlet, and the distance between Tanjung Lokang Hamlet and Bu'ung Hamlet is quite far. Namely, it must be traveled for approximately 1 hour and using water transportation for approximately 15 minutes. **Table 1** shows community perceptions of the social aspects of the construction of parallel roads.

Most agree that the road benefits the community by supporting education and public health. The limitations influence the low level of education in the community in terms of accessing secondary to tertiary education centers. With a parallel road, the ease of accessing education centers will support improving the community's education level. Related to the health sector, the community considers that road construction helps the community utilize health facilities in the city center. Limited access via water transportation makes it difficult for the community to seek treatment at the health center or hospital in Putussibau. However, the community is helped by the availability of a health center in Tanjung Lokang village with one health worker. The majority of the community agrees that the construction of the road also improves technology and the flow of information in the village, as evidenced by the construction of the *Bakti Kominfo* tower, so that currently in Tanjung Lokang Hamlet, there is an internet signal, although it is still limited. The existence of a parallel road also supports population migration. The increase in population is illustrated by the information that the people of Bungan Jaya Village, about 13 km from Tanjung Lokang Village, will move to Tanjung Lokang Village when the road is completed. In addition, based on information from local teachers, some teachers want to apply to be teachers in Tanjung Lokang village if the road is completed; this will also support the improvement of the education level of the Tanjung Lokang Village community. Parallel roads will improve community welfare, as shown by the results from (Alam et al. 2024), which found that road construction can improve community welfare.

The construction of parallel roads certainly helps the community enter and leave the village, but 83% of the community in Bu'ung Hamlet disagrees with this opinion. The Bu'ung Hamlet community believes that the construction of parallel roads has not been enough to help the community enter and leave the village because the parallel road is far from Bu'ung Hamlet. The community must use water and land transportation to reach the parallel road. Meanwhile, 100% of respondents from Tanjung Lokang Hamlet find it easier to get to the parallel road because it is already connected to the village road. So that people can use motorized vehicles to leave the village and go to the parallel road.

Another social aspect is the norms and culture of the local community, which are likely to change with the construction of parallel roads. Respondents' opinions in Tanjung Lokang Village show that the construction of parallel roads supports the community in maintaining the norms that apply to community life. The community believes that its life before and after the parallel road will not change too much because they have customary devices and rules. However, the customary rules also need to be adjusted to support increased village security with the existence of a parallel road that facilitates access for people outside the village to Tanjung Lokang Village. The construction of the parallel road also does not interfere with the existence of sacred areas around Tanjung Lokang Village because of community involvement in determining the location or route of the parallel road so that it does not interfere with sacred areas.

Furthermore, there are different opinions between respondents from Tanjung Lokang Hamlet and Bu'ung Hamlet regarding traditional medicine. Respondents in Bu'ung Hamlet mostly assume that there will be a possibility of changes in community habits in the use of traditional medicines because people can already access conventional medicine. However, for respondents in Tanjung Lokang Hamlet (72%), traditional medicine will be maintained to support community health, especially for types of rhizomes, betel, and other medicinal plants that exist and are planted in the village.

3.2.2. Economic aspect

From an economic perspective, it is known that the construction of parallel roads is very beneficial for the people of Tanjung Lokang Village. The majority of people in both Tanjung Lokang Hamlet and Bu'ung Hamlet agree that the existence of parallel roads can increase people's income, improve people's livelihoods such as the desire people to open new jobs, including workshops, fuel stalls, gardening activities, and make fish ponds around the road by utilizing fields owned by the community. A summary of perceptions from the economic aspect is presented in **Table 2**.

In addition, the community's farming activities and the existence of parallel roads allow the agricultural products produced by the community to be sold to Putussibau through land transportation

access via parallel roads. The existence of roads can also improve health facilities and infrastructure, education, and meet the desire of the community to have motorized vehicles. This is due to changes in the community's mindset, shifting from water transportation using boats with 40 HP speed engines to land transportation using cars and motorbikes. Community empowerment in Tanjung Lokang Village has also helped improve the community's economy through Trigona bee cultivation and nature tourism management activities. The positive perception is certainly not impossible to achieve because open access from production centers to growth center areas will increase farmers' selling power and impact increasing people's per capita income (Gomez et al. 2016).

The local community's perception of the construction of parallel roads reflects the community's hopes for their future lives. The greatest hope is from the socio-economic aspect, where parallel roads will open up public access that has been very limited so far. This condition is in line with what is found in various other developing countries in tropical areas, namely that the existence of roads will increase the effectiveness of expanding agricultural activities, increase market access by reducing transportation costs, increase interest in continuing education to a higher level, and enabled the provision of infrastructure including electricity (Aggarwal 2018; Hak et al. 2018; Khandker et al. 2009; Mu and van de Walle 2011; Rammelt and Leung 2017).

3.2.3. Environmental aspect

The study results on community perceptions of environmental aspects due to the construction of parallel roads in the TNBK area are relatively different compared to social and economic aspects. Development activities are often not in line with environmental aspects, especially if the development activities are carried out in a conservation area. From an economic perspective, it is known that the community's desire to improve its economy through land clearing/cultivating land and carrying out activities around parallel roads is certainly contrary to the protection of the TNBK area. The existence of parallel border roads allows for a decrease in water, soil, and air quality and causes flooding and erosion. Although the community has not felt these conditions, they still think the activities do not damage the environment. However, there needs to be supervision and prevention of the consequences of the construction of parallel roads. Community perceptions from the environmental aspect are briefly shown in **Table 3**.

The Tanjung Lokang Village community has not fully agreed with the commitment to preserve animals and plants; this also needs special attention regarding preserving the biodiversity of animals and plants. The construction of parallel roads will increase community activities by clearing land around the road and disrupting the existence of protected animal and plant species. Public awareness is important to prevent this so that public awareness arises to participate in preserving animals and plants in the TNBK area. One of the habits of the Tanjung Lokang Village community is shifting cultivation. This activity has an impact in the form of expanding fields or land-clearing activities for farming. Shifting cultivation can expand the forest used as a field if carried out continuously. Suppose the field is considered to no longer provide good results for the community. In that case, the community will look for a new location for farming. Meanwhile, the old fields will be abandoned, and it will take a long time for the forest to become a forest again. These activities will threaten the sustainability of forests and biodiversity, and deforestation will become inevitable. There is a relationship between the existence of roads in forest areas and deforestation that occurs in the global world from time to time (Angelsen and Kaimowitz 2001; Geist and Lambin 2009).

In addition, illegal activities such as mining (gold mining), logging (forest logging), and poaching (animal hunting) cause a decrease in environmental quality, such as damage to water quality, soil quality, and even air quality. In addition, large-scale forest encroachment for housing construction activities or others causes a decrease in the number and types of biodiversity, especially tree species. Hunting activities outside areas where protected animals are prohibited from being hunted are some types of animals targeted for protection in the Betung Kerihun National Park area. The construction of parallel roads can certainly increase these illegal activities, with easy access to transportation for the wider community to come to Tanjung Lokang Village to carry out these activities. Investment in these activities is increasingly open, threatening the conservation area's sustainability. So, there needs to be strategic anticipation that can prevent these potential risks (Hamersma et al. 2017).

Another potential risk due to the construction of parallel roads is high community expectations. The road benefits the community and supports the activities of the Tanjung Lokang village community.

However, high community expectations, such as the wishes of the community after the road is completed (can be seen from the positive perception of the community towards the construction of parallel roads), also pose a threat to the protection of the Betung Kerihun National Park area where the location of Tanjung Lokang Village and the parallel road are located in the area. The many wishes and hopes of the community for the road are likely to be a threat of encroachment and damage to forest areas. Parallel road development might create a new problem, like forest conversion. Forest conversion not only poses risks to people but also to plants and animals living in the forest. For this, the community must know the regulations and policies related to conservation areas. Local and national governments can work with conservation activists, NGOs, and universities to resolve this issue through community engagement (Sayektiningsih and Hayati 2021).

Strengthen community empowerment through activities implemented in Tanjung Lokang village, such as enrichment of fruit types or horticultural plants in agroforestry locations and increasing markets/promotions through appropriate training activities. Empowerment materials on plant cultivation patterns in the form of agroforestry need to be continued because the community's culture is still accustomed to directly harvesting results without planting. Empowering women in the village through skills training programs in productive economic efforts. Empowerment activities are more often aimed at heads of families, generally men. It is only right that women in Tanjung Lokang Village should also be involved in empowerment activities that can support the household economy. Dayak women contribute to their agricultural activities (Roslinda et al. 2023). Improving community education is very necessary. The assumption is that the higher the community's education, the more awareness of the importance of conservation areas will increase. A persuasive approach with traditional leaders and community leaders needs to be continued, and the use of customary rules needs to be elaborated on, including the rules for utilizing forest areas to meet the community's economic needs. So, parallel road development can support conservation areas that strive to incorporate and balance the needs of people and biodiversity (Riggs et al. 2020).

4. Conclusion

The local community's perception of the construction of parallel roads is generally positive from a social, economic, and environmental perspective. The community believes that their socio-cultural life will not be disturbed because they have an agreement in the form of traditional rules that are still adhered to by all levels of society. The opening of parallel roads provides great hope for a better economic life because the opening of road access to the village will facilitate economic activities and open up job opportunities for the community. There is a slight difference in perception between the communities of the two hamlets regarding the environment. However, in general, the community stated that the opening of parallel roads would not affect environmental conditions. The positive perception of the local community towards the construction of parallel roads needs to be addressed wisely, considering that development is being carried out in a conservation area. High hopes for the community's welfare must be balanced with the area's sustainability. For this reason, it is necessary to increase the capacity of human resources to manage the area further through community empowerment activities (community training), strengthening the role of village governments, and CSR programs from contractors/developers so that economic development goals can be aligned with environmental sustainability.

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