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CONSTRUCTION OF ENVIRONMENTAL ROADS IN PADANG CERMIN VILLAGE IN THE DEVELOPMENT OF LANGKAT REGENCY AREA

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ABSTRACT

This study aims to analyze the existing conditions of environmental roads before development, assess the impact of development on community mobility and economic activities, and identify supporting factors, inhibitions, and sustainability strategies for road construction in Padang Cermin Village, Lalat Regency. The method used is a descriptive qualitative approach, with data collection through field observations, interviews with the community and village officials, and documentation. The results of the study show that before construction, the condition of the environmental roads in Padang Cermin Village was still in the form of dirt and was heavily damaged, thus hampering the mobility of residents and economic activities. After development, there was a significant increase in accessibility, a decrease in transportation costs, an increase in the number of MSMEs, and an increase in community participation in economic activities. The construction of environmental roads plays an important role in supporting the development of the Langkat Regency area, especially in accelerating local economic growth and strengthening inter-regional connectivity. Key supporting factors include government support, community participation, and institutional collaboration. The recommended sustainability strategies are improving the quality of infrastructure, periodic maintenance, community empowerment, and integration of development with regional economic development plans. Thus, the construction of environmental roads in Padang Cermin Village has been proven to provide significant economic, social, and spatial benefits for the sustainable development of the Langkat Regency area.

Introduction

Road infrastructure development is one of the main components in supporting regional development, especially in rural areas that still face limited accessibility. Environmental roads have a strategic role in facilitating community mobility, accelerating the flow of goods and services, and increasing connectivity between regions. In Langkat

Regency, especially in Padang Cermin Village, the construction of environmental roads is an urgent need along with the increase in economic activity and population growth that requires adequate transportation access. Padang Cermin Village as one of the areas with considerable agricultural and trade potential still faces obstacles in terms of basic infrastructure. The condition of environmental roads that were previously damaged or unpaved often hindered people's mobility, especially in transporting agricultural products and meeting daily needs. This has an impact on the low economic efficiency of the village and limited opportunities for regional development. The construction of environmental roads is expected to overcome these problems by increasing connectivity between hamlets and opening access to economic activity centers in sub-districts and districts.

Figure 1.1 Map of the Village Area of Padang Cermin Village

In terms of regional development, the improvement of the environmental road network not only has an impact on the physical aspect, but also has a multiplier effect on other sectors such as education, health, and trade. Good roads facilitate students' access to schools, facilitate the distribution of health services, and attract local investors to develop businesses at the village level. Thus, the construction of environmental roads is one of the important instruments in encouraging local economic growth and improving community welfare. In addition, the construction of environmental roads in Padang Cermin Village is in line with the Langkat Regency Government's policy which is oriented towards equitable development between regions and improving the quality of basic rural infrastructure. This effort is part of a regional development strategy to reduce the gap between regions and strengthen the connectivity of rural areas to economic growth centers.

Table 1.1 General Data of Padang Cermin Village Area

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Description	Remarks
Districts	Stuttgart
Districts	Finish
Village	Mirror Field
Area Area	± 18.5 km²
Total Population (2024)	3,274 inhabitants
Number of Heads of Families	835 KK
Number of Hamlets	5 Hamlets
Key Livelihoods	Farmers (58%), Traders (17%), Labourers (15%), Others (10%)
Main Road Access	The ± 6 km Regency Road passes through the village
General Infrastructure Conditions	Quite good, but some of the environmental roads are still dirty and heavily damaged

Based on Table 1.1, Padang Cermin Village is one of the villages located in Finish District, Lalat Regency, with an area of ±18.5 km². This village consists of 5 hamlets with a total population of 3,274 people or around 835 heads of families in 2024. This number shows that Padang Cermin Village has a moderate population density, with a relatively even distribution of population throughout the hamlet. Most of the people of Padang Cermin Village depend on the agricultural sector, which accounts for about 58% of the total labor force. In addition, 17% of the community works as traders, 15% as day laborers, and another 10% work in the service sector and other informal activities. This livelihood composition shows that the village economy is still highly dependent on local agricultural products and trade activities which require adequate transportation infrastructure support to distribute production.

Padang Cermin Village is traversed by a ±6 km district road which serves as the main connecting route between the village and the center of economic activity in the sub-district. However, most of the environmental roads in the village are still in the form of dirt roads with severely damaged conditions, especially in hamlet areas that are some distance from the main road. The condition of village infrastructure in general is quite good, but internal accessibility problems are still the main obstacle for the community in carrying out daily social and economic activities. The existence of an inadequate road network causes the travel time to the center of the sub-district to be longer, especially during the rainy season when dirt roads are difficult to pass. This situation directly affects the smooth distribution of agricultural products, access to education and health facilities, and the efficiency of labor mobility. Thus, the construction and improvement of the quality of environmental roads is very important to support the development of the Padang Cermin Village area.

Tabel 1.2 Data Potensi Dampak Pembangunan Jalan Lingkungan

Aspek Dampak	Sebelum Pembangunan	Setelah Pembangunan (Proyeksi)
Waktu tempuh ke pusat kecamatan	45–60 menit	20–30 menit
Biaya angkut hasil pertanian	Rp 15.000/kg	Rp 7.000/kg
Jumlah pelaku usaha kecil (UMKM)	15 unit	30 unit
Frekuensi distribusi hasil panen	2 kali/minggu	4 kali/minggu
Partisipasi masyarakat dalam kegiatan ekonomi	60%	85%

Based on the table of the potential impact of environmental road development in Padang Cermin Village, it can be seen that improving road infrastructure has the potential to have a significant impact on various social and economic aspects of the community. One of the most noticeable changes can be seen in the efficiency of travel time to the district center, which originally took about 45–60 minutes to only 20–30 minutes after the construction of the road is completed. This increase shows an increase in accessibility between regions, which not only facilitates community mobility, but also supports the smooth running of public services such as education, health, and government administration. From an economic perspective, the cost of transporting agricultural products has decreased significantly from Rp 15,000 per kilogram to around Rp 7,000 per kilogram. This shows that road repairs directly reduce logistics costs and improve the efficiency of the production distribution chain. With lower transportation costs, farmers and traders can get a larger profit margin, thereby increasing the household income of rural communities.

In addition, data shows an increase in the number of small business actors (MSMEs) from 15 units to 30 units after the construction of environmental roads. This improvement illustrates that good road access is able to stimulate local economic growth and open up new business opportunities, especially in the trade, services, and agricultural product processing sectors. Adequate road infrastructure makes the flow of goods and people smoother, thereby expanding the marketing network and facilitating the entry of raw materials and other necessities. The frequency of crop distribution has also increased from 2 times per week to 4 times per week, which indicates an increase in productivity and economic turnover at the village level. This condition reflects that good environmental roads not only play a role as a means of mobility, but also as an economic infrastructure that is able to accelerate the production and distribution cycle of goods.

Furthermore, the level of community participation in economic activities increased from 60% to 85%, indicating that road construction encourages wider social and economic engagement. With easier access, the community becomes more active in market activities, business training, and economic cooperation between hamlets. This also strengthens the social capacity of the village community in supporting sustainable regional development. In the context of this study, the general data shows a direct relationship between the condition of road infrastructure and the potential development of village areas. Good environmental roads not only function as a means of transportation, but also as a driver of local economic growth, equitable development between hamlets, and improvement of community welfare. Therefore, the construction of environmental roads in Padang Cermin

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Village is expected to be a catalyst in accelerating the process of transforming rural areas towards more inclusive and sustainable development in Langkat Regency. However, in the process of implementation, the construction of environmental roads also requires careful planning, community participation, and synergy between related parties so that the benefits can be felt in a sustainable manner. With this development, it is hoped that Padang Cermin Village can develop into a more productive, competitive, and able to contribute to the development of Langkat Regency as a whole.

Problem Identification

Based on the background and supporting data that has been described, several problems that are the focus of this study can be identified, including:

1. The condition of environmental roads in Padang Cermin Village is still mostly in the form of dirt roads with a fairly high level of damage, thus hindering the mobility of people between hamlets.
2. The cost of transportation of agricultural products and the logistics needs of the community is still high due to limited adequate road access.
3. The travel time of the community to the center of the sub-district is relatively long, especially in the rainy season, which has an impact on the decrease in the efficiency of economic and social activities.
4. Local economic growth, especially small and medium enterprises (MSMEs) activities, is still limited due to the isolation of access and lack of infrastructure support.
5. Community participation in economic activities and village development has not been optimal due to limited accessibility and transportation facilities.
6. The construction of environmental roads has not been fully integrated with the development plan of the Langkat Regency area, so it has not had a maximum impact on improving the welfare of the village community.

Problem Formulation

Based on the identification of the above problems, the formulation of the problems in this study can be formulated as follows:

1. What are the existing conditions of environmental roads in Padang Cermin Village, Langkat Regency, before construction?
2. What are the impacts of environmental road development on the mobility, economic and social activities of the people of Padang Cermin Village?
3. What is the role of environmental road development in supporting regional development in Langkat Regency?
4. What factors are the supporters and obstacles in the implementation of environmental road construction in Padang Cermin Village?
5. What strategies can be done so that environmental road construction can be sustainable and provide optimal benefits for regional development?

Literature Review

2.1 Accessibility and Regional Development Theory

The concept of accessibility plays an important role in the study of regional development: accessibility measures the ease of relations between locations (villages — markets — administrative centers) and is a key variable that determines the flow of goods, services, labor, and information. Improved accessibility through environmental road improvements tends to reduce spatial barriers thereby enabling the integration of local economies into

broader markets, encouraging diversification of jobs, and minimizing the cost of transactions between regions. Recent studies emphasize that the analysis of the impact of transport infrastructure must combine traditional economic dimensions (such as changes in income) and spatial dimensions (shifts in land-use patterns and interregional relationships).

2.2 The Economics of Transportation: The Effects of Time and Cost Reduction

The theory of transportation economics describes how infrastructure improvements reduce travel costs (time and money costs), which directly impacts supply chain efficiency and producer revenue. Reduced travel time and transportation costs make agricultural products more competitive in the market, reduce post-harvest losses, and can increase the frequency of distribution. Empirical evidence in studies in the late 2010s and early 2020s shows a direct effect of reduced transport costs on increased trade frequency and farmers' access to markets, although the effect on household incomes may vary according to local contexts (e.g. availability of alternative markets, local institutional quality).

2.3 Impact of Rural Roads on Local Economic Development

Recent empirical literature finds that improving the quality of rural roads often drives structural changes in the local economy: the shift of the workforce from the agricultural sector to non-farm work, the growth of MSMEs, and increased access to education and health services. But the results also showed a heterogeneity of effects between regions—some studies reported increases in real income, while others found stronger effects on indicators of access (e.g., schools, markets) than on household consumption in the short term. Therefore, when assessing environmental road improvement interventions, it is important to pay attention to contextual aspects such as the existence of the destination market, the capacity to store/process the results, and the mechanism of profit distribution to the local community.

2.4 Community Participation and Road Development Governance

Development participation and governance theory emphasizes that the sustainability and effectiveness of village infrastructure projects are highly dependent on the involvement of local communities in planning, monitoring, and maintenance. Community participation increases a sense of belonging, reduces the risk of conflict and deviation, and can improve the quality of implementation because local knowledge can make the design more suitable for field conditions. Recent research in the Indonesian context also underscores the importance of transparent mechanisms for village fund allocation and inter-institutional coordination (villages, sub-districts, technical offices) to ensure the impact of road construction is truly pro-people and sustainable.

2.5 Road Sustainability, Resilience and Maintenance

The theoretical foundation of modern infrastructure development requires attention not only to construction but also to aspects of sustainability and resilience. Environmental roads designed without taking into account drainage, local materials, and operation-maintenance (O&M) costs are at risk of deterioration quickly, resulting in diminished long-term benefits. Best practices and sustainable funding guidelines (e.g. O&M financing models, limited private participation, planned village fund allocation) are critical for road improvements to produce long-term benefits for regional development. Financing institutions and road maintenance policies have also proven crucial in maintaining the benefits of rural infrastructure investment.

Research Methodology

3.1 Research Approach

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This study uses a qualitative approach because it aims to understand in depth the social phenomena that occur in the field, especially regarding the implementation and impact of environmental road development on regional development in Padang Cermin Village. A qualitative approach was chosen to obtain a holistic picture of the perceptions, experiences, and meanings felt by the community, village officials, and other related parties towards the changes that occurred after the construction of road infrastructure.

According to Creswell and Creswell (2023), qualitative research focuses on the exploration of the meaning of individuals or groups to a social problem, where researchers act as the main instrument in collecting and interpreting data. While Aspers and Corte (2021) emphasize that this approach does not simply collect facts, but also seeks to understand the social context and subjective interpretations of the actors involved.

Thus, this study not only assesses the results of road construction physically, but also examines how the community interprets changes in accessibility, economic activities, and quality of life after construction is carried out. This approach allows researchers to capture social and economic dynamics that cannot always be quantitatively measured.

3.2 Types of Research

This type of research is a case study, because it focuses on one specific location, namely Padang Cermin Village as an analysis unit. According to Yin (2020), case studies are used to investigate contemporary phenomena in real-life contexts when the boundaries between phenomena and their context are not apparent. In other words, environmental road construction is studied as a social process that is integrated with geographical, economic, and local policy conditions.

The case studies also allow for an in-depth exploration of various aspects that affect the effectiveness of development, such as community participation, village governance, and local government support. This approach is in line with the view of Baxter and Jack (2020) that case studies are well suited to answering the questions of "how" and "why" in the context of complex social phenomena.

3.3 Research Location and Time

This research was conducted in Padang Cermin Village, Finish District, Langkat Regency. This location was chosen purposively (purposive sampling) because this village is one of the areas that has experienced significant environmental road construction in the last two years and has socio-economic characteristics that reflect rural dynamics in Lalat Regency.

The research period was carried out from July to October 2025, including the stages of field observation, interviews, documentation, and data analysis.

3.4 Data Sources and Types

The data used in this study consisted of:

1. Primary data, namely data obtained directly from in-depth interviews with informants such as village heads, village officials, community leaders, MSME actors, and local residents affected by road construction.
2. Secondary data, namely data obtained from government documents such as *the Padang Cermin Village Profile (2024), the 2024–2029 Langkat Regency RPJMD*, the PUPR Office report, and data from the *Langkat Regency Central Statistics Agency (2024).*

According to Silverman (2022), the combination of primary and secondary data is very important in qualitative research to ensure the credibility and triangulation of information, so that research results can be scientifically accounted for.

3.5 Data collection techniques

The data collection techniques used include:

1. In-depth Interview

The interview was conducted in a semi-structured manner with open-ended question guides to explore the informant's perceptions and experiences. Kvale and Brinkmann (2021) refer to interviews as "meaningful interactions" between researchers and participants to uncover the meaning of life experiences.

2. Field Observation

Observations are carried out to record the real condition of environmental roads, community activities, and changes that occur after construction. According to Flick (2023), observation helps researchers understand social contexts that respondents cannot verbally explain.

3. Documentation

Secondary data is collected through official documents such as roadmaps, development reports, photos of activities, and local news. Documentation is used to reinforce the results of interviews and observations, in accordance with Bowen's (2019) suggestion that public documents can be a rich source of data for qualitative analysis.

3.6 Data Analysis Techniques

Data analysis was carried out using the interactive model Miles, Huberman, and Saldaña (2020) which includes three main steps, namely:

1. Data Reduction – selecting, focusing, and simplifying raw data from interviews and observations.
2. Data Display – displays information in the form of narratives, tables, or thematic maps for easy interpretation.
3. Conclusion Drawing/Verification – interpreting the meaning of data by connecting theories and field findings.

The analysis process is carried out in a cyclical (iterative) manner, where researchers repeatedly review the data to ensure the validity and accuracy of the findings.

3.7 Data Validity

To ensure the validity of the data, this study uses triangulation techniques, both triangulation of sources, techniques, and time. Lincoln and Guba (2020) state that credibility in qualitative research can be achieved by comparing various sources of information to find consistency of meaning. In addition, member checking is carried out by confirming the results of the interpretation to the informant to ensure that the meaning obtained is in accordance with their perception.

Results and Discussion

What is the existing condition of environmental roads in Padang Cermin Village, Lalat Regency, before the construction was carried out

Before the implementation of the construction of environmental roads, the condition of transportation infrastructure in Padang Cermin Village, Finish District, Langkat Regency can be categorized as still inadequate. Based on the results of observations and village data in 2024, most of the environmental road network is still in the form of dirt and gravel roads, with heavily damaged, potholes, and muddy surface conditions during the rainy

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season. Of the total length of environmental roads in this village, only a small part has been hardened with sirtu (stone sand) or asphalt, while the rest has not been handled optimally. This condition causes accessibility between hamlets to be hampered, especially during the rainy season, where the road cannot be passed by four-wheeled vehicles and is even difficult for two-wheeled vehicles to pass. As a result, the social and economic activities of the community become inefficient. People who want to go to the center of Selesai sub-district require a travel time of between 45 to 60 minutes, although the actual distance is relatively close, which is about 10-12 kilometers.

From an economic perspective, the condition of damaged roads has a direct impact on the cost of distributing agricultural products. Most of the residents of Padang Cermin Village work as farmers (about 58%), who rely on land transportation to sell their crops to the market of the nearest sub-district or town. Inadequate roads have led to an increase in transportation costs of up to Rp 15,000 per kilogram, especially for commodities such as rice, vegetables, and palm oil. This condition reduces farmers' profit margins and has an impact on the slow economic growth of the village. In addition, limited road access also hinders the development of small and medium enterprises (MSMEs). Based on data in 2024, the number of MSMEs in Padang Cermin Village only reaches 15 business units, most of which are engaged in small trade and simple agricultural product processing. The lack of transportation facilities makes it difficult for business actors to obtain raw materials and distribute products to a wider market.

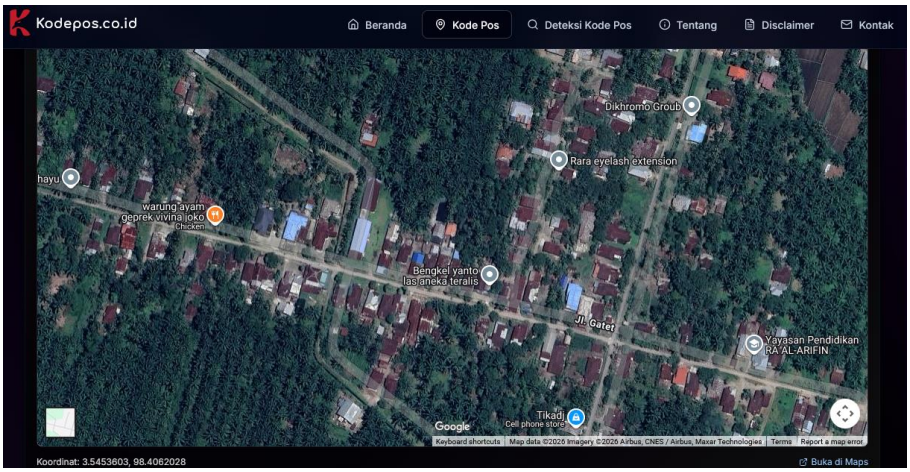

Figure 1.1 Existing condition of environmental roads in Padang Cermin Village

From the social side, damaged road conditions also have an impact on people's access to public services such as education, health, and government. School children often have difficulty reaching school, especially in the rainy season, while people who need health services at the sub-district health center have to travel long distances with slippery and unsafe road conditions. In general, the existing condition of environmental roads in Padang Cermin Village before construction illustrates the existence of infrastructure gaps between regions, which is one of the main obstacles to sustainable village development. This shows the importance of environmental road development interventions as a strategic effort to improve connectivity, accelerate economic distribution, and expand access to public services. Thus, it can be concluded that before the development, the quality of the road network in Padang Cermin Village was not able to optimally support the socio-economic

activities of the community, and became a limiting factor in efforts to realize inclusive and equitable regional development in Lalat Regency.

What are the impacts of environmental road development on the mobility, economic and social activities of the people of Padang Cermin Village

The construction of environmental roads in Padang Cermin Village, Finish District, Langkat Regency has had a significant impact on various aspects of people's lives, especially in terms of mobility, economic activities, and social dynamics. Environmental roads as basic infrastructure have an important role in opening up regional isolation, improving connectivity between hamlets, and accelerating the flow of goods and services that support the improvement of community welfare.

1. Impact on Community Mobility

Before the development, the people of Padang Cermin Village experienced limited mobility due to damaged and impassable road conditions, especially in the rainy season. After the construction of the neighborhood road was carried out, the travel time to the sub-district center decreased from 45–60 minutes to only 20–30 minutes. This shows an increase in the efficiency of the movement of people and goods.

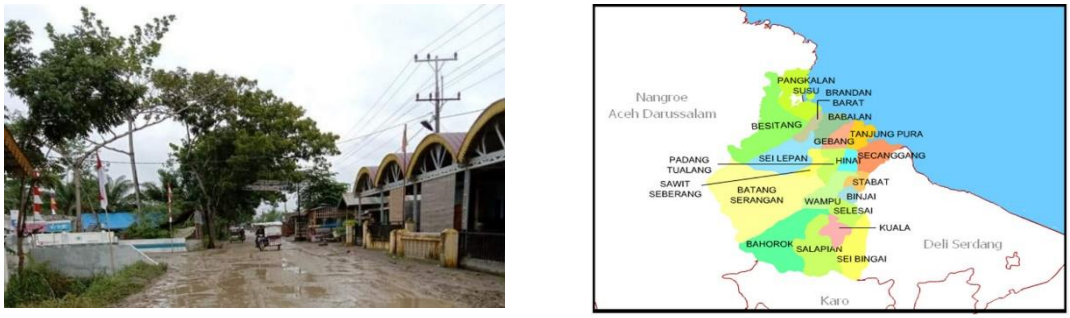

Figure 4.2 Quality of Padang Cermin Village Road

Improving the quality of roads also makes access to schools, markets, health facilities, and government offices easier and safer. People can now use four-wheeled vehicles smoothly, even public transportation has begun to reach the village area. This ease of access not only improves daily mobility, but also strengthens social relations between regions and accelerates the exchange of information and public services.

With the increase in connectivity, villages that were previously relatively isolated are now beginning to be integrated with economic activity centers in sub-districts and districts. Another positive impact is the increase in the frequency of distribution of agricultural products from two to four times a week, which indicates that road construction contributes directly to logistics efficiency and smooth transportation of goods.

2. Impact on Economic Activities

From an economic perspective, the construction of environmental roads brings significant changes to the productive activities of the community. Better road access reduces the cost of transportation of agricultural products from Rp 15,000/kg to around Rp 7,000/kg. This

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shows that there is efficiency in the supply chain, which ultimately increases the income of local farmers and traders.
In addition, increasing accessibility encourages the growth of the number of small business actors (MSMEs) from 15 to 30 business units. Adequate road infrastructure makes it easier for business actors to obtain raw materials, expand marketing networks, and accelerate the distribution of products to larger markets, both at the sub-district and district levels.
The ease of transportation also attracts investors and small entrepreneurs to develop businesses in the trade, culinary, and service sectors. Several hamlets in Padang Cermin Village began to develop into new economic activity centers, with increasing buying and selling activities and interactions between residents. This condition shows that the construction of environmental roads plays a role as a catalyst for village economic growth, which is able to drive local productive sectors.

3. Impact on the Social Life of the Community
In addition to the economic impact, the construction of environmental roads also has a positive influence on the social life of the community. Improving the quality of roads expands the reach of the community in interacting, both between hamlets and with other areas. Access to educational institutions and health facilities has become easier, thus having an impact on improving the quality of human resources and social welfare.
The level of community participation in social and economic activities increased from 60% to 85%. This shows that infrastructure development is able to strengthen social solidarity and foster the spirit of mutual cooperation in village development activities. In addition, community activities in religious, cultural, and village government activities have become more active due to the support of adequate transportation access.
The construction of environmental roads also increases public perception of local governments, because the benefits are felt directly by residents. Community trust and participation in development programs increases, which is an important social capital in encouraging the sustainability of village development.

Overall, the construction of environmental roads in Padang Cermin Village has provided a wide multiplier effect on increasing mobility, economic growth, and strengthening the social life of the community. Road infrastructure not only functions as a means of transportation, but also as a driving force in the sustainable development of rural areas. With increased accessibility, people have greater opportunities to grow businesses, expand social networks, and improve quality of life. Therefore, the construction of environmental roads can be said to be a strategic foundation in realizing the equitable distribution of development and development of the Langkat Regency area in a sustainable manner.

What is the role of environmental road development in supporting regional development in Langkat Regency
The construction of environmental roads has a strategic role in encouraging the process of regional development in Langkat Regency, especially in rural areas such as Padang Cermin Village, Finish District. Road infrastructure is not only a physical means for mobility, but also a development instrument that is able to drive the economic, social, and spatial dynamics of a region. Through increasing connectivity between regions, the construction

of environmental roads is the main driver for the creation of equitable development and the improvement of community welfare.

1. Role in Improving Regional Connectivity and Accessibility

One of the main roles of environmental road development is to improve accessibility and connectivity between hamlets, between villages, and between villages and the center of sub-districts or districts. Before the construction, Padang Cermin Village was relatively isolated due to the condition of the road that was damaged and difficult to pass, thus hindering the mobility of the population and the distribution of agricultural products. After the construction of the road, inter-regional access became smoother and more efficient, marked by a reduction in travel time to the sub-district center from about 60 minutes to 30 minutes.

This increased connectivity has direct implications for the ease of people in obtaining basic services such as education, health, as well as government and economic activities. In the context of regional development, this shows that environmental roads function as the main connecting infrastructure (local connector) that integrates rural areas into the broader economic system in Lalat Regency.

2. Role in Encouraging Local Economic Growth

The construction of environmental roads also has an important role in driving the economic sector of the village community. Good road infrastructure reduces the cost of transportation of agricultural products and business logistics, as well as increases the efficiency of goods distribution. In Padang Cermin Village, the cost of transporting agricultural products decreased by almost half — from Rp 15,000/kg to Rp 7,000/kg — after the construction of the road was completed.

This condition has a positive impact on increasing the income of farmers and small business actors. The number of MSMEs increased from 15 units to 30 units, which shows the growth of new economic activities such as trade, services, and processing of agricultural products. Thus, the construction of environmental roads functions as an economic stimulus that is able to create a multiplier effect on regional growth. In addition, increasing access to transportation encourages the formation of new economic activity centers (local growth centers) around environmental roads. This supports the transformation of the village economy from a traditional agriculture-based economy to a more dynamic and diversified economy.

3. Role in Improving Social Life and Public Services

In the social aspect, the construction of environmental roads strengthens social interaction and community cohesion. Better road access makes it easier for people to attend social, religious, and cultural activities, thereby strengthening solidarity and participation in development. The data on community participation in economic activities increased from 60% to 85% showing an increase in the active role of residents in village development and social activities.

In addition, the construction of environmental roads also affects increasing access to public services. People are now more easily able to reach education and health facilities, which were previously difficult to access due to damaged road conditions. Thus, the construction of environmental roads plays a role as a support for the equitable distribution of public services, which is one of the indicators of the success of regional development.

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4. Role in Supporting Equitable and Regional Integration of Langkat Regency
The construction of environmental roads in Padang Cermin Village also contributes to efforts to equalize development between regions in Lalat Regency. As an area with diverse geographical characteristics — consisting of coastal areas, lowlands, and hills — Langkat Regency requires an even transportation infrastructure to effectively connect the entire region.
With the construction of an environmental road network, rural areas that were previously left behind can now be integrated into the district economic system. This strengthens the function of Padang Cermin Village as part of the supporting area for growth centers in Selesai District and the surrounding economic area. The construction of environmental roads also supports the implementation of the Langkat Regency Regional Spatial Plan (RTRW), which places the improvement of transportation infrastructure as a top priority in supporting economic development and the welfare of rural communities.

5. The Role of Sustainable Development and Village Independence
Finally, the construction of environmental roads in Padang Cermin Village plays a role in strengthening the foundation of sustainable development and village independence. With good transportation access, people have greater opportunities to develop local potential, such as productive agriculture, trade, and rural tourism.
In addition to the economic impact, this development also fosters public awareness of the importance of maintaining infrastructure and participating in road maintenance, so as to create a participatory and sustainable development pattern. This is in line with the principle of community-based development which emphasizes the active role of residents in the development process and the management of its results.
Overall, the construction of environmental roads in Padang Cermin Village has an important role in supporting the development of the Langkat Regency area. Environmental roads are not only a means of mobility, but also an instrument of economic, social, and spatial development that accelerates regional integration, grows new economic centers, and strengthens people's welfare. Thus, improving the quality of environmental roads is an integral part of the strategy of equitable and sustainable regional development in Langkat Regency.

What factors are the supporters and obstacles in the implementation of environmental road construction in Padang Cermin Village
The implementation of environmental road construction in Padang Cermin Village, Finish District, Langkat Regency, is influenced by various factors that are supportive and inhibiting. These factors include technical, social, economic, and policy aspects, which directly or indirectly affect the effectiveness, sustainability, and benefits of road construction.
1. Supporting Factors
   a. Local Government Support and Infrastructure Policy

One of the main factors that supports the construction of environmental roads is the commitment of the local government of Langkat Regency in providing a budget and setting priorities for village infrastructure development. Clear planning in *the Regional Medium-Term Development Plan (RPJMD)* and the allocation of funds for the construction

of environmental roads strengthen the smooth implementation of the project. This policy support is in line with the findings of research by ADB (2022) that the success of rural infrastructure development is highly dependent on the commitment of local governments in the provision of resources and integrated planning.

b. Community Participation

The active participation of villagers in the planning, supervision, and maintenance stages of roads is a significant supporting factor. Directly involved communities can provide input on local conditions, suitable materials, and realistic traffic patterns. Silverman (2022) emphasizes that local community involvement increases the sense of ownership and sustainability of projects. In Padang Cermin Village, community participation increased to 85% after construction, demonstrating strong social support for the project.

c. Availability of Material Resources and Local Labor

The use of local materials such as sand, stone, and village labor speeds up the construction process and lowers construction costs. The availability of local resources also supports the sustainability of post-construction road maintenance. This factor is in line with the principles of *community-based development*, which emphasizes cost-effectiveness and community involvement.

d. Favorable Geographical and Topographic Conditions

Padang Cermin Village has an area with a mostly flat to light undulating topography, thus allowing the construction of environmental roads with relatively low construction costs and risks. These favorable geographical conditions speed up the construction process and minimize technical barriers.

2. Inhibiting Factors

1. Budget Constraints and Funding Sources

Despite the support of local governments, budget constraints are often an obstacle. Some environmental roads have not received adequate funding allocation, so construction must be carried out in stages. This resulted in a non-uniform construction process and some parts of the road were still in an emergency condition or had not been handled.

2. Weather and Rainy Season Factors

The long rainy season and high rainfall intensity in Langkat Regency are significant obstacles. Roads that have not been paved tend to deteriorate faster, complicate the implementation of construction, and incur additional costs for temporary repairs. This factor is in line with the findings of Dumas (2025) who called extreme weather one of the main obstacles to rural road construction in the tropics.

3. Limited Capacity of Technology and Experts

The construction of environmental roads requires technical expertise in planning, drainage calculations, and the selection of suitable materials. The limited number of experts at the village or sub-district level can affect the quality of the road and its long-term resilience.

4. Social Conflict or Local Interests

Some minor conflicts related to land acquisition, division of maintenance responsibilities, or differences in development priorities between hamlets can hinder the process. This conflict requires good mediation between the village government and residents to maintain the smooth running of the project.

5. Lack of Awareness of Road Maintenance by the Community

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Even though the road is built, less regular maintenance by the community or related parties can cause a rapid decline in road quality. Awareness of sustainable maintenance remains a major challenge in ensuring the long-term benefits of environmental road construction.

The implementation of environmental road construction in Padang Cermin Village is influenced by a combination of supporting and inhibiting factors. Key supporting factors include government support, community participation, availability of local resources, and supportive geographical conditions. Meanwhile, inhibiting factors include budget limitations, weather conditions, limited experts, conflicts of interest, and lack of maintenance awareness. It is important for the next environmental road development planning to maximize supporting factors and minimize inhibiting factors through integrative, participatory, and sustainable strategies so that road construction has an optimal impact on regional development in Langkat Regency.

What strategies can be done so that the construction of environmental roads can be sustainable and provide optimal benefits for regional development

In order for the construction of environmental roads in Padang Cermin Village, Finish District, Langkat Regency to be sustainable and provide optimal benefits for regional development, a comprehensive series of strategies is needed. This strategy must consider technical, social, economic, and institutional aspects so that environmental roads not only function as a temporary means of transportation, but also as an instrument to drive long-term local development.

1. Improving Infrastructure Quality and Selecting the Right Materials

Road quality is the main factor in the sustainability of development. The first strategy is to use materials that are suitable for geographical conditions, climate, and local traffic loads. For example, the use of permeable asphalt or light concrete on flood-prone sections, as well as drainage improvements along the road to prevent erosion and waterlogging. According to Dumas (2025), the right material selection and good drainage planning can extend the life of the road to 20–30 years. In addition, it is necessary to carry out periodic planning for routine maintenance, including checking road conditions, minor repairs, and drainage cleaning. This ensures that the road remains in optimal function and reduces the cost of major repairs in the future.

2. Community Empowerment and Active Participation

Local community involvement is key to sustainability. The second strategy is to increase the participation of villagers in road maintenance and supervision through mutual cooperation mechanisms or independent village programs. This active participation not only reduces the cost burden, but also fosters a sense of ownership of the infrastructure. In addition, community training on road maintenance, drainage maintenance, and simple road repair techniques can increase local capacity. This approach is in line with the principles of community-based infrastructure development, which emphasizes the importance of the role of the community as managers and beneficiaries of development projects (Silverman, 2022).

3. Policy Support and Sustainable Funding

The next strategy is to ensure local government policy support and long-term budget availability. The district government needs to integrate the construction of environmental roads into the Regional Medium-Term Development Plan (RPJMD) and the village budget on a regular basis, so that road maintenance is not dependent on incidental projects. Funding can also be strengthened through partnerships with the private sector, CSR institutions, and local communities. With a clear funding mechanism, road construction can be sustainable, maintain its quality, and have a maximum economic impact on the village.

4. Institutional Strengthening and Coordination Between Parties
The success of environmental road construction also depends on coordination between the village government, sub-districts, related agencies, and the community. This strategy includes the formation of a village road management team, periodic monitoring, and effective coordination mechanisms in planning, implementation, and evaluation of development. With strong institutions, all technical and social problems can be resolved faster, such as land disputes, local traffic regulation, and resource allocation. Baxter and Jack (2020) emphasize that effective institutions are an important factor in the success of community-based development.

5. Integration with Regional Development and Economic Activities
The last strategy is to integrate the construction of environmental roads with village economic and social development programs. The roads built must be a driver of economic activities, such as the distribution of agricultural products, access to MSMEs, and local tourism. Thus, roads are not only a means of transportation, but also a catalyst for economic growth and community welfare. In addition, integration with village spatial planning, district transportation routes, and economic activity centers can ensure that the construction of environmental roads provides optimal benefits for the sustainable development of the Langkat Regency area.

Conclusion

Based on the results of research on the construction of environmental roads in Padang Cermin Village, Lalat Regency, it can be concluded that:

1. The existing condition of the road before construction shows that the infrastructure is damaged, narrow, and unpaved, thus hindering community mobility, especially in the distribution of agricultural products and access to the sub-district center.
2. The construction of environmental roads has a real impact on increasing mobility, travel time efficiency, reducing transportation costs, and increasing local economic activities. Travel time to the sub-district center was reduced from 45-60 minutes to 20-30 minutes, and the cost of transporting agricultural products decreased from Rp 15,000/kg to Rp 7,000/kg.
3. From the social and economic aspects, there has been an increase in community participation in economic activities (from 60% to 85%) and an increase in the number of MSMEs (from 15 units to 30 units), which indicates the role of environmental roads as a driver of the rural economy.

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4. The role of environmental road development in regional development is very significant because it improves connectivity between regions, expands access to public services, and accelerates local economic growth.
5. The main supporting factors for the success of development include local government support, community participation, and synergy between agencies, while the inhibiting factors are limited funds, topography conditions, and maintenance that is not optimal.
6. Sustainability strategies that need to be implemented include periodic maintenance, community empowerment in road maintenance, strengthening village institutions, and integration with regional economic development programs.

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