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# Integration of Sustainability Indicators in Regional Road Policy: East Kolaka, Indonesia

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**Abstract**

The suboptimal integration of sustainability indicators in regional road policies in East Kolaka Regency, Indonesia, has resulted in infrastructure development that does not pay attention to environmental, social and economic aspects in a balanced manner. This study aims to analyze the integration of sustainability indicators and identify implementation barriers in regional road infrastructure policies in East Kolaka Regency. Employing a qualitative approach and thematic analysis, data were collected through in-depth interviews, field observations, and document reviews involving key actors from government agencies, civil society, and the private sector. The findings reveal that sustainability integration has been pursued through the use of environmentally friendly technologies, improved economic connectivity through agropolitan strategies, and community participation in planning processes. However, implementation remains challenged by complex geographic conditions, limited human and financial resources, political interventions, and administrative constraints. These findings highlight the importance of localized sustainability indicators and the need for improved governance and inter-agency coordination to achieve inclusive and sustainable road development.

Keywords: Sustaibility Indicators, Infrastructure Policy, Implementation

## INTRODUCTION

Road infrastructure development is a strategic component in promoting regional connectivity, economic growth, and equitable development. However, the success of road development is not only measured by physical achievements, but also the extent to which the project accommodates the principle of sustainability. In today's global era, the sustainable development approach has become a normative and operational


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requirement that demands integration between economic, social and environmental dimensions in every stage of development, including in the land transportation sector (Yang et al., 2020).

In Indonesia, road development has been regulated through various regulatory instruments such as Law No. 38/2004 on Roads, Government Regulation No. 34/2006, and Presidential Regulation No. 79/2019. However, while the legal framework is in place, implementation challenges at the sub-national level remain enormous. Various studies have shown that the implementation of road development is often faced with fragmentation of authority, low technical and institutional capacity, and dependence on central transfer funds such as the Special Allocation Fund (DAK) that are not fully aligned with regional needs (Pambudi et al., 2022)

East Kolaka District, Southeast Sulawesi, is an area facing how these challenges are manifested in the region. In the period 2021 to 2024, the condition of road infrastructure in East Kolaka Regency experienced significant fluctuations, with good condition roads initially showing a positive increase of 17.99% in 2022 and 42.66% in 2023, but then experiencing a decrease of 8.78% in 2024, while medium condition roads continued to decline sharply with a decrease of 77.31% in 2023 and 40, 07% in 2024, while damaged roads experienced a dramatic decline of 61.24% in 2023 and 91.53% in 2024, but most worryingly a spike in the severely damaged road category that increased in 2023 and grew to 51.23% in 2024, reflecting that infrastructure improvement efforts have not been matched by a sustainable maintenance strategy, resulting in serious degradation of some roads that require urgent attention from local governments. This condition not only impacts the local economy, but also widens the gap between regions.

The barriers to sustainable road development can be classified into four dimensions: (1) structural, such as weak cross-sector coordination and overlapping regulations; (2) technical, including a lack of spatial data and professional human resources; (3) fiscal, reflecting dependence on the central budget and low prioritization of local budgets; and (4) sociopolitical, such as local resistance to policy innovation and lack of community participation in planning (Abolhasani et al., 2023).In addition, the absence of standardized sustainability indicators is one of the main obstacles in

promoting adaptive and evidence-based road development. Sustainability indicators should include economic (life cycle cost efficiency), social (accessibility and impact on community welfare) and environmental (carbon emission reduction, ecological impact mitigation) aspects. However, at the local level, such indicators are rarely used as a basis for evaluation or development planning.

Most previous studies have focused on technical aspects and road construction, such as material quality, implementation methods and cost-effectiveness. Meanwhile, studies that integrate barriers to policy implementation and the development of sustainability indicators within one analytical framework are limited. Therefore, this article addresses this gap by further exploring the inhibiting dimensions inherent in the local context of East Kolaka, as well as developing sustainability indicators that are relevant for local governments to apply in medium and long-term planning.

Using a sustainable governance approach, this research is expected to contribute to strengthening local road development governance that is not only responsive to connectivity needs, but also aligned with the principles of sustainable development.

## LITERATURE REVIEW

Public policy failure is a frequent phenomenon and can be caused by various factors, so in the process of policy implementation it is necessary to pay attention to the following factors: 1). Ambiguity, both in unclear objectives and unclear ways of implementation, is often a major cause of policy failure because it leaves room for different interpretations that cause implementation to deviate from the original objectives (Signé, 2017). 1). Lack of Vertical Participation and Power Disparity, Policy failures often occur due to a lack of stakeholder involvement, especially local actors, so that policies become unrealistic and less suitable for needs, plus the imbalance of power between the center and the regions which makes implementers on the ground feel less ownership of the policy (Huencho, 2021). 2). Discrepancy between Objectives and Implementation by Street-Level Bureaucrats, the discretion of street-level bureaucrats causes discrepancies between policy objectives and implementation, as they adjust policies to the real conditions on the ground (Selepe, 2023). 3). Lack of Resources, lack of resources such as funds, labor, and time, so that even though the

policy is well designed, it causes ineffectiveness (Abolhasani et al., 2023). 4). Politics and Conflict, both at the formulation and implementation stages, often hamper policy implementation due to differences in views and priorities that prevent mutual agreement (Abolhasani et al., 2023)

Development as a social planning process is an effort by development bureaucrats to create changes that aim to improve people's welfare in a sustainable manner, conceptualized as continuous improvement towards a better life, where the level of welfare of a country can be measured through various indicators (Zein & Septiani, 2023). Sustainable development is a key concept in global policies that encourages communities to meet current needs without damaging natural resources, thereby improving the quality of life without harming ecosystems or causing environmental problems such as deforestation, pollution, climate change, and species extinction (Mensah, 2019). Sustainable development is a key concept in global policies that encourages communities to meet current needs without damaging natural resources, thereby improving the quality of life without harming ecosystems or causing environmental problems such as deforestation, pollution, climate change, and species extinction (Ranga & Rani, 2023)

Environmental Responsibility, Evaluation of social responsibility and the implementation of an integrated approach that includes aspects of technology, project management, and ecology, by involving stakeholders, assessing environmental impacts comprehensively, using environmentally friendly materials, and adopting green infrastructure and alternative transportation so that road construction can meet the needs of the community while preserving natural resources for future generations (Maelissa et al., 2023). Economic Efficiency, by adopting a comprehensive and economic efficiency-oriented approach in the development of road infrastructure, it can ensure that public investment generates optimal socio-economic benefits while maintaining environmental sustainability for the future (Bezugliy et al., 2022). Social Responsibility, The development of socially responsible road infrastructure requires thorough evaluation, identification of constraints, and the active participation of stakeholders, with the implementation of CSR as an effort that benefits local

communities and encourages investment, but requires strict regulation and effective coordination between levels of government (Arsinta & Ichsan, 2021).

Resilience and Adaptation to Climate Change, Climate change resilience and adaptation in sustainable road infrastructure development requires an integrated approach, including design adjustments, the use of nature-based solutions, careful risk assessment, and the use of technology and climate data to make roads more resilient to the impacts of climate change and support development. Innovation and Technology, The application of innovation and technology aims to create a functional and environmentally friendly road network with resource efficiency, where smart technologies such as IoT, AI, blockchain, as well as connected and electric vehicles can improve efficiency, safety, and support sustainable development goals. (Schinkel et al., 2022). Sustainable Mobility and Integration, An approach that combines transportation efficiency with economic, social, and environmental sustainability through the integration of transportation modes, renewable energy, and smart infrastructure, thereby reducing environmental impact, increasing social access, and supporting economic growth with cross-sector collaboration to meet today's needs without sacrificing the future (Kussl & Wald, 2023). Sustainable road infrastructure planning and maintenance is essential to maintain quality, reduce environmental impact, and optimize costs with strategies such as predictive maintenance, pavement management systems, multi-criteria approaches, and integration of BIM tools to improve efficiency and sustainability (Kale et al., 2023).

Innovation is urgently needed to improve the efficiency and function of the road transportation system. according to (Nowicka-skowron, 2019) The proposed innovations include Digitalization and automation where the application of information technology and automated systems influence in improving logistics and transportation management.

Other opinions (Levchenko & Dmytriiev, 2023) about the great opportunities of the transportation sector through innovation, can be reviewed from several aspects, namely: Digitalization and Smart Technology (2) Use of More Environmentally Friendly Construction Materials and Technologies (3) Automation and Autonomous Vehicles, (4) Renewable Energy Development.

Sustainable development, as defined by (Mensah, 2019), emphasizes meeting current needs without compromising the ability of future generations to meet their needs. In this context, the implementation of sustainability indicators is crucial for measuring and evaluating the impact of every development undertaken (Yang et al., 2020). Furthermore, effective regional transportation policies, as discussed by (Brilhante & Klaasen, 2018), play a vital role in ensuring that road infrastructure development not only meets connectivity needs but also aligns with sustainability principles.

## RESEARCH METHOD

This research uses a qualitative approach with a descriptive approach. The research location was East Kolaka Regency, Southeast Sulawesi Province. The focus of this research is the development of regional road infrastructure in East Kolaka Regency. There are two data sources in this research, namely primary and secondary data. Primary data is data obtained in the field through observation and interviews. Secondary data sources are obtained from documents in East Kolaka Regency and previous research. Interviews were conducted with informants related to the research focus that had been determined through interview guidelines.

The analysis process of this research uses a qualitative approach by using thematic analysis techniques to process data. The components in the data analysis model (thematic analysis) according to Braun & Clarke (Heriyanto, 2018) are as follows: 1). Familiarizing with Data In the early stages of analysis, researchers understood the data in depth by reading the interview transcripts regularly and noting important things found in the data. 2). Generating Initial Codes The next step is coding, which is labeling or categorizing important parts of the interview transcripts. The codes given can be descriptive (according to the participant's words) or interpretive (finding deeper meaning). In this stage, codes that have similarities are grouped into one category. 3). Searching for Themes After the codes were organized, the researcher began to determine the main themes obtained from the data. The themes used describe phenomena that are relevant to the research questions. 4). Reviewing Themes The next step was to revisit the themes to ensure relevance and consistency with the original

data and to check the relationship between one theme and another, so as to form a broader pattern of understanding. 5). Producing the Report The final step is to organize the results of the analysis in the form of a coherent narrative.

The data collection method includes three main techniques, namely in-depth interviews, field observations, and documentation studies. In-depth interviews were conducted by involving informants who have strategic relevance to road infrastructure development policies, including officials from the Public Works and Spatial Planning Office (PUPR), the Regional Development Planning Agency (Bappeda), elements of civil society, and actors from the private sector. Field observations were carried out directly at the road construction site as well as at the offices of the agencies involved, to observe the implementation of policies, the dynamics of coordination between institutions, and the factual condition of the infrastructure. Meanwhile, a documentation study was conducted to examine secondary data such as planning documents, project activity reports, statistical data from the Central Statistics Agency (BPS), and regional regulations related to road construction. The following table shows the results of a thematic analysis of challenges in implementing sustainable road development in East Kolaka (table 1).

**Table 1. Results of Thematic Analysis: Challenges in Implementing Sustainable Road Development in East Kolaka**

| Main Theme | Sub-theme | Data |
|---|---|---|
| Technical Challenges | Unstable Natural Conditions | The unstable soil and high rainfall often hinder road construction and require additional costs for stabilization (Interview with the Head of the Public Works and Public Housing Agency) |
| Non-Technical Challenges | Limited Human Resources | The number of staff competent in infrastructure is very limited, resulting in suboptimal project supervision (Field observation) |
| Social-Political Challenges | Political Intervention in Decision Making | Budget allocation decisions are often influenced by political interests rather than technical needs. (Analysis of Local Government Budget Documents) |

The population in this study includes all actors who have involvement in the process of planning, implementing, and supervising road construction policies in East Kolaka Regency. The informant selection technique uses the purposive sampling method, which is the deliberate selection of individuals or parties who are considered to have sufficient competence, experience, and knowledge about the issues being studied. This approach allows researchers to obtain in-depth, relevant, and contextual information according to the focus of the research.

It should also be noted that in measuring environmental sustainability indicators, this study uses evaluation criteria that refer to AMDAL (Environmental Impact Analysis) standards and the use of environmentally friendly construction materials. For economic indicators, the impact of improved road accessibility on increased farmer income and reduced transportation costs was analyzed.

## RESULT AND DISCUSSION

### Integration of sustainability in development

#### *Environmental Aspects*

East Kolaka Regency, as one of the regions that is intensively carrying out road infrastructure development, realizes the importance of integrating sustainability principles in every project that is implemented. Based on the results of the research, the East Kolaka Regency Government has made efforts to pay attention to environmental aspects in road infrastructure development projects. This is reflected in several strategic steps implemented, such as the use of environmentally friendly technology, adaptation of road design to geographical conditions, and the selection of construction materials that take into account the characteristics of the local soil.

East Kolaka Regency is demonstrating its commitment to integrating sustainability principles into infrastructure projects. The use of the latest specifications and equipment aims not only to improve efficiency, but also to minimize negative impacts on the environment. Another effort made is a policy to maintain soil stability in areas with challenging geographical conditions, such as mountain slopes. The Acting Chairman of the Public Works Office said that they applied the soil compaction method without having to replace the entire soil layer. This approach is more sustainable because it can reduce construction waste and minimize the overexploitation of natural resources.

But even though East Kolaka Regency has implemented environmentally friendly technology, the long-term effectiveness of this approach still needs to be studied further. Factors such as road maintenance, periodic evaluations of environmental impacts, and community involvement in environmental management around road infrastructure must be taken into account to ensure the sustainability of these policies.

***Economic Aspects***

Road infrastructure development is one of the key elements in encouraging economic growth and improving people's welfare. In areas with an agriculture-based economy such as East Kolaka Regency, the quality of road infrastructure is a determining factor in smoothing the distribution of production products, reducing transportation costs, and strengthening connectivity between regions. Therefore, it is important to evaluate how economic aspects can be used as indicators of sustainability in the implementation of road infrastructure development in this area.

This research shows that adequate road infrastructure not only increases people's mobility but also accelerates the turnover of production and distribution of goods, especially in the agricultural sector which is one of the main sectors in this area. Improving the quality of roads in agricultural areas has a direct impact on the efficiency of agricultural product distribution. Before the paving of the road, farmers had difficulty in transporting crops due to poor road conditions. But after paving, they can easily take the produce to the mill, which ultimately increases the competitiveness of their products in the market. This distribution efficiency also lowers farmers' operational costs and increases their profits. From the perspective of highway engineers, the development of good road infrastructure also contributes to the decline in commodity prices because transportation costs are lower. With better road access, distribution costs are lower, so that the price of goods becomes more stable and people's purchasing power increases.

In the target term of road construction carried out in East Kolaka as a form of effort to support the agropolitan program, namely an agriculture-based development strategy that integrates the production, processing, and marketing sectors more efficiently. With better access, agricultural products can be delivered to the market faster, so that economic added value increases and economic growth becomes more evenly distributed in the East Kolaka area. Medium-term development programs that focus on improving connectivity between regions have also shown positive results. Areas that were previously difficult to reach are now more open, allowing economic activity to flourish.

Economic sustainability in road infrastructure development in East Kolaka Regency can be measured through three main indicators, namely the efficiency of the distribution of production products, which allows farmers and business actors to obtain greater economic benefits, reduced transportation costs, which contributes to price stability and increased purchasing power of the community, and increased connectivity between regions, which opens up economic opportunities in remote areas and supports economic growth which is more even.

***Social Aspects***

Sustainable road infrastructure development not only relies on economic and environmental aspects, but must also consider the social dimension to ensure optimal benefits for the community. The results of this study show that the social aspect in the implementation of road construction in East Kolaka Regency is realized through the active participation of the community in the planning and implementation process of development. This approach is in line with the principles of sustainable development that emphasize inclusivity and stakeholder engagement.

The Development Planning Deliberation (Musrenbang) is one of the main mechanisms used to ensure that road construction is in accordance with the needs and aspirations of the local community. Currently, the Kolaka district government is actively involving the community in various stages of development, the implementation of road construction projects also involves the community in identifying needs and implementing projects in the field.

This participatory approach provides several positive implications. First, community participation in the planning and implementation of road construction increases the sense of ownership of the infrastructure being built. Thus, the community tends to play a greater role in road maintenance and support the sustainability of the project in the long term. Second, community involvement allows for transparency in decision-making, which can minimize the potential for social conflicts and increase public trust in local governments.

The results of this study answer research questions about how social aspects are indicators of sustainability in road infrastructure development in East Kolaka Regency.

The involvement of communities in every stage of development reflects the principles of social justice and inclusivity, which are the main foundations in the concept of sustainable development.

Based on the results of the analysis carried out, social aspects play an important role in ensuring the sustainability of road infrastructure development in East Kolaka Regency. The participatory approach implemented by local governments, involving the community in the planning and implementation process of development, not only increases the effectiveness and suitability of the project with the needs of the community, but also encourages a sense of ownership and responsibility for the infrastructure being built.

## Challenges in the Implementation of Road Infrastructure Development in East Kolaka Regency *Technical Challenges*

### *Natural Conditions*

With geographical characteristics dominated by hilly and mountainous areas, as well as soil types that tend to be unstable, East Kolaka faces a dilemma between the need to provide adequate road access for the community and technical obstacles that must be overcome. The main challenge in the implementation of local road infrastructure development in East Kolaka Regency is unstable natural conditions. Soft and labile soil structures are a significant obstacle in the road construction process. Although this type of soil condition is good for agriculture, it is inversely proportional to the need for road construction which requires a hard and stable soil base. To overcome this, extra efforts are needed such as compaction and reinforcement techniques repeatedly so that the road structure is not easily bumpy or damaged in the future. The soil stabilization process is complex and takes a short time, thus affecting the overall development schedule. In addition to the soil structure, erratic weather conditions are also an obstacle in the development supervision process.

The complexity of the geographical conditions of the East Kolaka region which has the characteristics of fertile but unstable soil, especially in cliff and mountainside areas. The selection of road routes through the mountainside is actually a cost-efficient effort, but it carries a high risk of landslides. This dilemma creates a major challenge in

road infrastructure development, where there is a need to build roads in a cost-efficient manner, but also to overcome unstable and landslide-prone soil conditions.

The results of this study show that the challenges of natural conditions, especially unstable soil structures and uncertain weather, are factors that affect the implementation of local road infrastructure development in East Kolaka Regency.

### *Structural Challenges*

The structural technical challenges in road infrastructure development in East Kolaka Regency consist of two main aspects, namely low soil stability and vehicle loads that exceed the capacity of the road. The condition of the labile and fertile soil requires a modification of the Bina Marga standard, where additional selection management and improvement of the basic soil must be carried out before proceeding to the paving stage. This is reflected in the case at the Dadio Monument site, where although the DCP test showed good results, manual testing still showed soil instability, so the repair process had to be carried out repeatedly. On the other hand, the load of vehicles that exceed the capacity of the road, especially those used to transport timber in the rainy season or farmers' grain, also accelerates the degradation of road infrastructure. Therefore, the structural challenge in road construction in East Kolaka Regency lies not only in the application of technical standards, but also in the unique soil conditions and road use patterns that are not in accordance with their capacity.

Structural technical challenges in road infrastructure development in East Kolaka Regency require not only a technical approach that is in accordance with local conditions, but also effective policies and supervision to maintain the quality and durability of infrastructure in the long term.

## Non-Technical Challenges

### *Limited Human Resources*

Based on the results of the analysis of research data, East Kolaka Regency faces various challenges in the development of local road infrastructure. In the non-technical context, East Kolaka faces limited resources, both in terms of budget and human resources. The budget available for road construction is very limited, only around a few

tens of billions of rupiah every year. This is due to the portion of the APBD which is mostly allocated for employee spending and mandatory spending in the education sector. Thus, local governments cannot handle all road infrastructure needs optimally, which ultimately has an impact on less than suitable road conditions and increased repair costs in the future due to lack of routine maintenance.

In addition, limited human resources are also one of the challenges in the implementation of the policy. This challenge includes two important aspects, namely the quantity and quality of available human resources. In terms of quantity, East Kolaka only has about 50 staff who have to handle many work packages, a number that is far from sufficient considering the complexity and breadth of the area that requires repair and development of road infrastructure. This causes a high workload for the existing workforce and has an impact on the efficiency and effectiveness of project implementation.

In terms of quality, only about 20% of the total human resources are considered to have adequate competence. One of the speakers revealed that out of the 50 existing staff, only about 10 people have enough skills and expertise to handle infrastructure projects professionally. This condition shows that there is a gap in the technical and managerial capabilities of human resources working in road construction projects. The impact of the limited quantity and quality of human resources includes low work efficiency due to many workers lacking expertise in infrastructure project management, lack of optimal supervision and evaluation because existing staff do not have sufficient capacity to handle many work packages at once, and delayed project implementation due to a lack of workers who truly understand technical standards for road construction. With this condition, the road construction process in East Kolaka Regency has become less than optimal and the local government faces major obstacles in implementing infrastructure development policies effectively.

***Socio-Political Challenges***

The implementation of road infrastructure development in East Kolaka Regency faces socio-political challenges related to negative public perception and political intervention in strategic decision-making. Negative public perception often arises due

to the lack of public understanding of development policies and misinformation spread on social media. This condition can lead to public distrust of the government, which ultimately has the potential to hinder public support for development projects. Therefore, an effective public information management strategy is needed to minimize the negative impact of wrong public perception.

On the other hand, political intervention is also a significant challenge in the development of local road infrastructure. The traditional political system causes strategic decisions not always based on the real needs of the community, but on certain political considerations. This has an impact on budget allocations and project priorities that are determined based on political interests, rather than on technical needs or infrastructure urgency. This condition can slow down or change the priorities of development projects, so there is a need for efforts to minimize excessive political interference in the development process.

***Administrative Challenges***

Based on the results of research in East Kolaka Regency, it revealed challenges in the implementation of local road infrastructure development policies, especially related to administrative obstacles in the process of disbursing funds from the central government to the regions. The disbursement system is carried out in stages, and each stage requires reporting and review by the regional inspectorate. However, the limited number of human resources in the inspectorate caused delays in the review process, which had an impact on the delay in the disbursement of funds in the next stage.

The results of this study show that although road construction policies have been designed with available budget allocations, the effectiveness of their implementation is highly dependent on administrative mechanisms at the regional level. Obstacles in the bureaucratic process can slow down the pace of development and result in delays in the completion of infrastructure projects.

The results of the research in East Kolaka Regency reinforce the importance of paying attention to administrative aspects and institutional capacity in the implementation of infrastructure development policies. Efforts are needed to strengthen coordination and collaboration between institutions, as well as increase the

capacity of human resources at the regional level so that the process of disbursing funds and project implementation can run more effectively and efficiently.

The integration of sustainability indicators into regional road policies is essential for fostering sustainable development, particularly in areas like East Kolaka, Indonesia. Sustainability indicators serve as important tools for assessing the environmental, economic, and social dimensions of road infrastructure and transportation systems. Incorporating these indicators requires careful consideration of local contexts, stakeholder perspectives, and the overarching goals of sustainability. The literature presents a nuanced understanding of sustainability indicators, emphasizing the need for a hybrid approach that merges both expert-led and citizen-led methodologies.

Turcu's analysis discusses the ongoing debate between these two approaches for developing sustainability indicators. While expert-led models provide technical rigor, citizen-led models offer valuable insights that reflect community values and needs (Turcu, 2013). This integration of perspectives can yield a more relevant set of indicators that align with the realities of the region, thereby enhancing the effectiveness of sustainability assessments. However, questions persist about the practical application of this integrated approach, particularly in regions like East Kolaka, where local knowledge and contexts significantly influence sustainability outcomes.

In the transportation sector specifically, indicators must correlate effectively with sustainable practices to ensure their utility in policy-making. The qualitative framework proposed by Naganathan et al. emphasizes the importance of continuously evolving indicators as more data and knowledge become available (Naganathan et al., 2020). This adaptability is crucial for East Kolaka, where transportation practices may vary considerably due to differing urban and rural dynamics. The integration of updated sustainability indicators can guide local authorities in making informed decisions regarding road policies that reflect the community's sustainability goals.

Furthermore, the economic implications of road pricing highlight the need for comprehensive planning and analysis. Zhong and Bushell present a spatial econometric perspective on how road pricing affects job accessibility, suggesting that such policies must consider their broader impacts on nearby regions (Zhong & Bushell, 2017). The potential inequities introduced by road pricing mechanisms underscore the necessity

for an equitable approach to sustainability indicators, particularly in East Kolaka, where socio-economic disparities may influence access to transportation resources.

Local authorities play a critical role in implementing climate change adaptation strategies within road networks. Begum et al. emphasize that the impacts of climate change are often most pronounced at local levels, necessitating a focus on enhancing the resilience of regional road infrastructures infrastructures (Begum et al., 2022). As East Kolaka confronts climate change challenges, incorporating indicators that measure resilience will be essential for developing road policies that are both sustainable and adaptive to changing conditions. Local leaders must prioritize building climate-resilient road infrastructure, supporting broader sustainability efforts while addressing immediate community needs.

Moreover, the equity effects of transportation investments require thorough evaluation. Ciommo and Lucas highlight the importance of developing tools that assess the accessibility outcomes of transport policies (Ciommo & Lucas, 2014). These tools can aid urban planners and other stakeholders in moving toward an accessibility-based approach rather than a purely mobility-oriented one. In the case of East Kolaka, such assessments will inform stakeholders about how road policies can be designed to increase accessibility while fostering sustainable transport practices that benefit all community members.

In summary, the integration of sustainability indicators into East Kolaka's regional road policy demands a multifaceted approach that synthesizes expert and local knowledge, remains adaptable to emerging data, and prioritizes equity and resilience. The convergence of varied methodologies, frameworks, and analytical perspectives will empower local authorities to formulate effective road policies that align with broader sustainability objectives. This proactive approach ensures that transportation systems not only facilitate movement but also contribute positively to the environmental, social, and economic fabric of the region.

The future trajectory of sustainability in road policy, particularly in developing regions like East Kolaka, will rely on continuous engagement with stakeholders, iterative improvements in indicator relevance, and a steadfast commitment to inclusivity. By harnessing an integrated framework of sustainability indicators, East Kolaka can strive to

be a model for regional development that respects local context while aligning with global sustainability goals. Embedding sustainability into the fabric of regional road policies will enhance the transportation network, elevate the quality of life for residents, and foster long-term viability.

Further research and policy experimentation will be crucial for understanding the effectiveness of various sustainability indicators within the regional context. The dialogue among various stakeholders government agencies, local communities, and academic institutions will be integral in refining these indicators, leading to more substantial, evidence-based policy decisions that advance sustainability in East Kolaka and beyond. Ultimately, the successful integration of sustainability indicators will facilitate a holistic approach to regional road planning, transforming transportation infrastructure into enablers of sustainable development.

Through collaborative efforts and a commitment to adaptive management, East Kolaka has the potential to emerge as a leader in sustainable transportation, setting an example for other regions facing similar challenges. The intersection of innovative road policies and sustainability frameworks will yield significant advancements in both community well-being and environmental stewardship, paving the way for sustainable futures.

So, the path toward integrating sustainability indicators into regional road policy in East Kolaka necessitates a diligent examination of both theoretical frameworks and practical applications, coupled with ongoing stakeholder engagement. The continuous evolution of these indicators with local input will ensure they remain relevant and impactful, ultimately guiding the region toward a more sustainable and equitable transportation future.

## CONCLUSION

This study shows that the development of road infrastructure in East Kolaka Regency has shown efforts to integrate sustainability principles in environmental, economic, and social aspects. However, policy implementation still faces significant challenges, including complex geographical conditions, limited human resources and budgets, and structural, administrative, and socio-political constraints. This information

indicates the need to improve governance, increase institutional capacity, and strengthen cross-sector coordination so that road construction can be carried out more effectively and sustainably for future development, similar studies can be carried out by conducting comparative studies between regions and developing more operational sustainability indicator models to strengthen the effectiveness of sustainable road infrastructure development governance.

Therefore, the East Kolaka Government can adopt a collaborative governance model that involves the active participation of the community, academics, and the private sector in the planning and supervision of road projects. Case studies from other regions that have successfully implemented a similar approach (e.g., [region name], [reference]) can serve as a reference in designing a model that is appropriate for the local context. Additionally, training and capacity building for staff in the infrastructure sector should be enhanced through collaboration with universities and technical training institutions.

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