



Strengthening Transport Infrastructure in Remote Areas Through A Penta Helix Collaboration Approach In West Aceh Regency

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A B S T R A C T

This study aims to analyze the application of *Penta Helix* collaboration approach in strengthening transportation infrastructure in remote areas in West Aceh Regency. This study is expected to provide insight for each *Penta Helix* actor in increasing the effectiveness of the development of collaborative transportation infrastructure and become the latest breakthrough that emphasizes socio-economic aspects to improve community welfare. The method used is a qualitative approach, through interview data collection techniques, observations and literature studies. The results of the study show that the *Penta Helix* elements, namely government, private sector, academia, society and media have contributed to the strengthening of transportation infrastructure. This contribution is the first step in creating a collaboration that can be an innovative solution for strengthening transportation infrastructure in remote areas. And can be an effort to overcome the challenges faced by each *Penta Helix* actor. This study recommends strengthening the synergy between *Penta Helix* elements by strengthening collaboration related to the systematic solution of problems that occur in remote areas, especially on transportation infrastructure issues, it is also necessary to develop information and coordination between *Penta Helix* elements and can also begin to develop ideas and concepts for the development of sustainable transportation infrastructure.

INTRODUCTION

Transport infrastructure has become very important to any business or activity that aims to facilitate the mobility of the community. An ideal transport infrastructure can have a major impact on economic, social, health and environmental growth (Baihaki et al., 2023). According to Hudson (1997) in (Syah, 2020), infrastructure is a form of facility that is central to the service process with the aim of facilitating the community in carrying out daily activities. Infrastructure includes telecommunications, electricity and water supply, sanitation, offices and government, commercial areas and also includes transport infrastructure (Sutrisno et al., 2024). On the other hand, transport in general is defined by Miro (2012) in (Juantoro et al., 2020) as an effort to move goods and people from one area to another with a specific purpose.

Transport infrastructure is an important part of the development process because infrastructure is the main pillar for the advancement of an area, promoting regional development and stimulating the economy in different aspects and business areas (Palilu, 2018). In rural or remote areas, the development of transport infrastructure is considered a priority need because it can promote the process of mobilisation and interaction between communities in an area (Caravario et al., 2023). Good transport infrastructure will increase the productivity and efficiency of a region's economy, increase investment and cooperation, and may create new jobs in the surrounding area (Awainah et al., 2024). These benefits are certainly expected by all sections of society, without exception for those living in remote or rural areas.

Remote areas are areas that are geographically, socially and economically isolated, remote areas usually include conditions

with low infrastructure, low education level and small community opinion (Rustiadi et al., 2018). Usually, remote areas experience lower development conditions and people's welfare compared to other areas (Syamsuri, 2019). Meanwhile, geographically, remote areas are areas whose territories experience isolation, which hinders the regional development process (Putri & Ramadhan, 2021).

However, to date, the development of transport infrastructure in remote areas still faces various obstacles. These include badly damaged roads (Nilawati et al., 2021), bridges that no longer guarantee the safety of crossing (Permani et al., 2018), and various other problems. The lack of transport infrastructure, such as bridges and roads, in remote areas often makes it difficult for the community to access services and hinders the development of village potential in an area, and can lead to difficulties in the economic and social progress of the community in that area. Similarly, in West Aceh District, limited transport infrastructure such as bridges and roads in some remote areas often become a major challenge for the community. Some areas, such as the gampong areas in Pante Ceureumen, Woyla, West Woyla, Panton Reu and Kaway XVI subdistricts, still receive many complaints from the public about the condition of damaged roads, making it difficult for people to carry out their daily activities.

Since it is often difficult for the government to deal with a region's road infrastructure, due to geographical conditions that are difficult to reach and the lack of information channels in some remote areas, the result is that problems related to transport infrastructure are neglected without any effort being made to solve them in the best possible way. Neither the government nor the community can be blamed, because the

government is often faced with various obstacles, both internal and external, and the same is true of the community, which is unable to channel its aspirations. If left unaddressed, this problem will have further consequences, such as hampering the distribution of the community's agricultural products, limiting access to health and education services, and widening socio-economic disparities in the region.

These conditions not only have implications for the isolation of communities in remote areas, but can also hamper the economic potential of the region as a whole (Rodzi, 2023). In addition, limited access to health services can increase the risk of mortality due to delays in receiving medical treatment, as good roads are essential in emergency situations (Rosyidah et al., 2024). Furthermore, limited access to education due to transport difficulties can have an impact on the low quality of human resources in the region, which in turn perpetuates the cycle of intergenerational poverty (Rahma & Kartiasih, 2024). Therefore, an in-depth study of effective strategies for providing transport infrastructure in remote areas is needed, especially considering a collaborative approach involving different stakeholders.

Under these conditions, an appropriate approach should be applied as an effort to solve the problems of transport infrastructure in remote areas. An approach that can be taken to ensure the provision of transport infrastructure such as roads and bridges can be accessed in remote areas, then Penta Helix collaboration can be the right solution to achieve the success of transport infrastructure development in West Aceh district. The Penta Helix Collaboration approach is often seen as a strategic solution in the process of solving various social issues. Collaboration is defined as a relationship between organisational elements that contribute to and support each other in achieving a goal.

Collaboration is also a relationship in which information and benefits are shared and mutual responsibility is taken to make decisions on problems that arise (Tampanguma et al., 2020). Meanwhile, Penta Helix is a form of multi-sectoral collaboration consisting of government, private sector, academia, society and media (Yesayabela et al., 2023), with this collaboration it will be able to develop transport infrastructure in remote areas. According to Siagian (2009) in (Sriwati et al., 2024) that the government has a functional role consisting of regulation, policy formulation, public services, law enforcement and order and security functions for the community.

Then there are academics who act as drafters because academics are able to study and evaluate and encourage the potential of an area, academics are also known as figures who are able to contribute ideas and thoughts to planning and problem solving (Septadiani et al., 2022). The private sector is known as an element that has advantages in providing capital and services, so it can be said that it is an element that facilitates the development of an area (Cahyo & Nuryanti, 2018). According to Khristianto et al (2024) the community has a role as active participation, being part of community cooperation, advocacy and monitoring a programme. The virtues of community participation in infrastructure development according to Conyer Diana (1994) in (Riskayanti et al., 2022) that community participation can be a tool to find out information from the conditions they face, such participation will also increase public trust and the values of democratic

rights of the community because they are considered involved in problem solving and regional development.

The last element in the pentahelix is the media, according to (Khatimah, 2018) the media plays a role in communicators who spearhead change for the public, because the media is able to become a figure who influences the public through sources of information, education and messages widely, in modern times information can be easily disseminated. Based on the definition and role of the Penta Helix, it means that each element has an important role in the development of an area, including the government, private sector, academia, society and even the media, of course this role is also important in the process of developing transport infrastructure.

Previously, there have been several previous studies that examined the Penta Helix concept in achieving goals and solving problems, such as the Penta Helix concept that became a strategy in the potential development process through the village economic barn model approach (Yunas, 2019). The Penta Helix model is also used in the development of tourism villages in Lampung Province (Sari et al., 2022) and Pekanbaru City (Vani et al., 2020), even Penta Helix collaboration can be a solution in the development of MSMEs after the pandemic in Dolly, Surabaya (Supriyanto & Iskandar, 2022). Based on several previous studies, it has been highlighted that the Penta Helix concept can be a strategy in tourism development and community economic empowerment. However, there are still few studies that discuss the implementation of the Penta Helix concept in strengthening transport infrastructure in remote areas.

In particular, Penta Helix is a form of collaborative approach that supports the active participation of different stakeholders, in this case, the collaborative model has the potential to be a solution to overcome the challenges related to transport infrastructure in remote areas such as West Aceh District, as the involvement of Penta Helix stakeholders is still limited. Based on this background description, this research aims to explore the contribution and form of Penta Helix collaborative approach in strengthening transport infrastructure in West Aceh Regency. This research is expected to provide insights to each actor in the Penta Helix model to increase the effectiveness of collaborative transport infrastructure development.

In addition, this research is an innovation that emphasises socio-economic aspects and strengthens infrastructure policy in remote areas through the penta-helix approach in the government's socio-political development. This study is in line with the vision and mission of sustainable development, where collaboration between stakeholders is key to creating inclusive and resilient infrastructure. Therefore, this study has academic significance in the development of the Penta Helix concept and can be a policy recommendation for local governments in designing more effective collaborative strategies for transport infrastructure development in remote areas to improve community welfare.

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METHOD

A descriptive qualitative method is used in this study, as this approach allows for a more in-depth understanding of the condition of transport infrastructure in remote areas of West Aceh district. This method was chosen to describe phenomena systematically and in depth based on data collected directly from relevant sources (Sugiyono, 2013). The data used in this study consisted of primary data and secondary data. Primary data were obtained through observation and interviews with resource persons selected through purposive sampling, namely representatives of pentahelix elements in West Aceh district. The resource persons included the Public Works and Spatial Planning Office (PUPR) of West Aceh, the Regional Development Planning Agency (Bappeda) for Infrastructure Development, academics from the Faculty of Engineering at Teuku Umar University, as well as representatives from the community, media and business actors.

The interviews were conducted as semi-structured interviews to allow in-depth exploration of each stakeholder's perspective. In addition to the interviews, field observations were conducted to observe the actual condition of road and bridge infrastructure in remote areas. Documentation was used as a secondary data source, including government reports, local development planning documents, and previous research focused on and related to the Penta Helix concept and transport infrastructure development in West Aceh (Sugiyono, 2017). Data analysis was conducted using the Miles and Huberman model, which includes data reduction, data presentation, and drawing conclusions (Miles et al., 2014). Data reduction aimed to filter out relevant information, which was then presented in narrative and thematic form. Conclusions were drawn by interpreting the findings to provide a comprehensive picture and strategic recommendations for transport infrastructure development in West Aceh Regency.

RESULT AND DISCUSSION

Transport infrastructure problems in remote areas of West Aceh Regency

Transport infrastructure is an important part of the development process because infrastructure is the main pillar for the advancement of a region, spurring regional development and stimulating the economy in various aspects and business scopes (Palilu, 2018). Transport infrastructure is indeed an important part of the mobility process for the community, not only in urban areas, but transport infrastructure is also an important need for people in rural areas. However, limited infrastructure in remote areas is often a major obstacle to social and economic activities. Many roads in rural areas are severely damaged, especially dirt roads, which are difficult to travel on during the rainy season due to mud and slipperiness, and the lack of street lighting, which hampers mobility at night. In

addition, the condition of bridges that are old and unfit for use also increases safety risks for the community.

West Aceh district itself currently has several remote areas that are classified as still experiencing problems in the development of transport infrastructure mobility, including rural areas in Panton Reu, Woyla, Kaway XVI, and Pante Ceuremen districts. These problems are caused by various factors such as natural disasters that occurred in Gampong Kajeung, Sungai Mas sub-district in 2022 (Akmal, 2022), landslides on the Jambak - Sikundo road in Pante Ceureumen sub-district (Sari et al., 2024). Apart from natural disasters, the transport infrastructure in West Aceh regency has also been damaged by heavy equipment transport activities, for example, in several villages in Pante Ceureumen regency, PT AJB's transport activities caused damage to the road transport infrastructure (Alatif, 2024). Efforts should therefore be made to strengthen cooperation between stakeholders, including the government, the private sector, academics, the community and the media.

Local Government Contribution

Government according to Siagian (2009) in (Sriwati et al., 2024), is an element that has a functional role consisting of regulatory functions, policy formulation, public services, law enforcement, and the function of maintaining order and security for the community. Based on the findings of interviews with the Head of Infrastructure Division of BAPPEDA and PUPR West Aceh Regency, that the government has a role in the development of transport infrastructure, which consists of several parts, including First, preparing RPJMD and RKPD documents related to transport infrastructure, in this case there are two transport areas managed by the marine and land infrastructure sectors; second, conducting patrols and supervision related to land transport infrastructure and cooperating with the Transportation Department and West Aceh District Police; third, developing goals, strategies and objectives for sustainable transport infrastructure development.

Fourthly, to be a mediator, regulator, catalyst and community facilitator in the transport infrastructure sector; To oversee the programmes of the PUPR, PERKIM, the Transportation Office, the Manpower Office and other related agencies; fifth, to be a forum for the community in providing aspirations and a forum for academics in carrying out the Tri Darma, and to cooperate with the media on issues that arise, Sixth, to organise the planning, organisation, implementation and maintenance of transport infrastructure, seventh, to realise an activity result in the form of useful construction and to fulfil the orderly implementation of construction workers, and finally, to innovate in sustainable development in the transport infrastructure sector in West Aceh Regency.

Academics' Contribution

Academics have a role as designers because they have the ability to study and assess a phenomenon that promotes regional potential, academics are also known as figures who are able to contribute ideas and ideas to planning and problem solving (Septadiani et al., 2022). One of the universities in West Aceh Regency that plays a role in regional development, including in the transport infrastructure sector, is Teuku Umar University. As part of the academic element in West Aceh Regency, this university naturally plays an important role in the regional

development of West Aceh Regency, including in the transport infrastructure sector.

Based on interviews with one of the students and lecturers of Civil Engineering Study Programme, it shows that academics have contributed to the development of transport infrastructure in remote areas, this role consists of various types of activities such as research, community service and creating quality human resource development. Academics are important in the development of regional transport infrastructure because students are one of the parties who are sensitive to a phenomenon, their analytical skills are able to obtain ideas and creativity that can spark new policies for a region. The role of academics can be in the form of research and innovation, where academics conduct studies related to appropriate technology for construction in remote areas where there are obstacles and challenges in the field of geography, such as bridge planning or flood resistant roads, the results of the studies obtained can be a scientific product in the form of journals or scientific papers, construction concepts, designs and community empowerment programmes.

Some forms of research conducted by academics related to transport infrastructure include: First, research related to road damage caused by overloading in West Aceh Regency (Wandi et al., 2016), second, assistance related to the repair of suspension bridges in Gampong Tanjung, Kaway XVI District (Sari et al., 2024), third, studies related to road performance on the Meulaboh - Tapak Tuan traffic road section (Erliana et al., 2020), fourth, transport economic studies related to road development in West Aceh Regency (Refiyanni, 2016) and finally, community empowerment in the form of improving road infrastructure with concrete pavement.

Private Sector Contribution

The private sector is known as an element that has advantages in providing capital and services, so it can also be said to be an element that becomes a facilitator in the development of an area (Cahyo & Nuryanti, 2018). In the development of transport infrastructure, this element also plays an important role and contributes to the success of the development, the private sector acts as a facilitator by providing capital goods and services in the process of developing an infrastructure, often the private sector becomes a cooperation partner in a development project because it can be a source of capital availability of raw materials, construction technology, professional human resources and even budget support in a transport infrastructure development plan.

Based on the research findings, the private sector is also involved in contributing to regional development in the form of CSR in the development of transport infrastructure in remote areas, such as the Gampong Sikundo area, Pante Ceureumen district (AcehKini, 2020). Other contributions include the provision of construction materials such as stone and sand to build village roads, and the provision of heavy equipment to work on roads that are difficult to access due to challenging geographical conditions. This private sector CSR programme is helping to accelerate the development of transport infrastructure in areas where access has been limited, resulting in improved community mobility, economic access and the distribution of agricultural products and local trade.

Community Contribution

The community has a strategic role in the development of transport infrastructure in remote areas because the community is the object of the main users of the development itself. In line with the opinion of Conyer Diana (1994) in (Riskayanti et al., 2022) that the community can be a tool to find out information from the conditions they face, therefore the presence of the community in the development of transport infrastructure is very important. Based on the results of this study, it was found that community aspirations, especially in the form of complaints about the condition of damaged roads and bridges, are often the main driving factor for the government in planning and following up on infrastructure development in the area.

In addition, communities can also contribute in the form of empowerment, participation in planning activities such as village development planning meetings (Musrenbang), assistance and support in providing land for infrastructure projects, participation in gotong royong activities for village road improvements, and support for the use of new technologies in road and bridge construction. Community participation in transport infrastructure development also has a positive impact on social and economic development in remote areas. From a social perspective, participation in activities such as musrenbang and gotong royong strengthens the sense of community and increases collective awareness of the importance of quality infrastructure.

Better transport infrastructure improves people's access to education, health, and other public services, which in turn improves their quality of life. From an economic perspective, improved roads and bridges open up new opportunities for people to engage in economic activities, such as facilitating the distribution of agricultural and fisheries products, increasing labour mobility, and promoting the growth of small and medium enterprises. Thus, active community participation not only accelerates infrastructure improvement but is also a major factor in promoting social welfare and economic growth in the region.

Media Contribution

The last element of the Penta Helix is the media, the presence of the media in the Penta Helix concept is the main support in the process of disseminating information related to transport infrastructure problems that occur in remote areas of West Aceh Regency, this is in line with the opinion (Khatimah, 2018), which states that the media has a role as a communicator who leads change for the public through sources of information, education and messages, such as the problems that occur today, many road or bridge damage is neglected due to the lack of information that is effectively channeled to the authorities. Therefore, the presence of the media through blow-ups of conditions on the ground helps to disseminate information thoroughly so that it reaches the government and the private sector, as shown in Figure 1 below.



Figure 1. Severely Damaged Road Conditions

Source: *HabaAceh* (Saputra, 2023)

The picture above is one of the results of Blow Up from online news media related to the condition of the connecting road between villages in West Aceh which is severely damaged, from this information it is hoped that there will be a follow-up in the development of road transport infrastructure in the region. so it can be interpreted that the media is able to contribute as an information bridge in the development of transport infrastructure in remote areas of West Aceh Regency. There are also some other media information related to the broken bridge in Gampong Cot Manggie (Firmansyah, 2023), minor damage to the suspension bridge in Gampong Tanjung, Meulaboh (Anggoro, 2024), damage to the wooden bridge floor in Gampong Cot Lada, Bubon regency (Dani, 2024), and the suspension bridge in Gampong Kajeung - Tungkop, Sungai Mas regency (News, 2024).

Penta Helix Collaboration in The Development Of Transport Infrastructure In Remote Areas

The Penta Helix approach is a form of multi-sectoral collaboration between government, private sector, academia, community and media (Yesayabela et al., 2023); with this collaboration, it will be possible to develop transport infrastructure in remote areas. Through the research study, it has been shown that each element of the Penta Helix has an important contribution with their respective roles in the development of transport infrastructure in remote areas of West Aceh Regency. Starting with the government as the policy maker, development programme manager, budget allocation, and so on. There is also the private sector as a facilitator, provider of capital and services, academics as a channel for ideas, research and empowerment, the community as a channel for aspirations, and the media as a communicator in transport infrastructure development issues.

With reference to each of these contributions, it is necessary to strengthen collaboration, as the success of transport infrastructure development in remote areas depends not only on one element, but also on each related element, including government, the private sector, the community, academics and the media. Because a transport infrastructure problem can be solved by the community's aspirations, which are highlighted by the media (Laksana & Yanti, 2023), it can become a study for the emergence of ideas and ideas from academic experts, facilitated by the private sector, and become a follow-up by the local government. In this way, the development of transport infrastructure in remote areas can be successful and community welfare can be realised.

CONCLUSION

Based on the results of the research and discussion, it was found that the development of transport infrastructure in remote areas of West Aceh District still faces various obstacles, such as damaged roads and bridges, which hinder the mobility of the community and access to basic services and the economy. One of the main factors causing these problems is the limited budget, difficult geographical conditions, and lack of synergy between stakeholders in planning and implementing infrastructure development.

In this context, this research shows that Penta Helix collaboration can be an effective approach to addressing transport infrastructure issues. Through the role of the government as a policy maker and implementer of development, the private sector as a provider of goods and services through investment and CSR programmes, academia in providing scientific studies and technological innovation, the community as an active participant in decision making and monitoring, and the media as a means of communication and advocacy, this collaboration can accelerate more inclusive and sustainable infrastructure development in West Aceh Regency.

This research does not discuss the barriers or challenges faced by each of the Penta Helix elements in contributing to the development of transport infrastructure in remote areas, so it cannot provide a comprehensive picture of the barriers to the application of Penta Helix collaboration. Based on the research findings outlined, there are several suggestions that can be made as recommendations for the development of transport infrastructure in remote areas. Namely: First, there should be a strengthening of Penta Helix collaboration in relation to the systematic problem solving that occurs in remote areas, especially on the issue of transport infrastructure; second, information development and coordination between Penta Helix elements are needed, especially in government and community elements, which are still relatively low in the level of coordination; third, academics can begin to develop ideas and suggestions for sustainable transport infrastructure development.

This study does not discuss the barriers or challenges faced by each element of the Penta Helix in contributing to the development of transport infrastructure in remote areas, so it cannot provide a comprehensive picture of the barriers to the application of Penta Helix collaboration. Therefore, it is recommended that further research be conducted by examining the specific challenges faced by each element of the Penta Helix, including budget constraints, coordination between stakeholders, and policies that support the sustainability of infrastructure development.

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