

The Impact of the Adian Naginjang Irrigation Network Development on Regional Development in Asahan Regency

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ABSTRACT

This study examines the impact of the Adian Naginjang Irrigation Network on regional development in Asahan Regency using a qualitative approach. Data collection methods include in-depth interviews, participant observation, and documentation, with triangulation ensuring data validity. The findings reveal a significant boost in agricultural productivity, with rice yields increasing by 40% and horticultural crops by 25% due to improved water supply. This growth has enhanced local economic activities, particularly SMEs in agricultural processing and marketing. Additionally, the irrigation development has driven infrastructure improvements, such as roads and storage facilities, facilitating market access and reducing costs.

INTRODUCTION

The Adian Naginjang irrigation network project was initiated to enhance water availability for agricultural land, especially in facing unpredictable seasonal changes and mitigating potential crop failures. Adequate irrigation is expected not only to boost crop yields but also to open up opportunities for regional development by optimizing land use. Asahan Regency holds significant potential as an agricultural region with extensive farmland resources. However, a high dependency on rainfall and the challenges of climate change have created uncertainty in water availability for agriculture, often resulting in reduced food production and affecting farmer welfare. This situation highlights the need for effective irrigation infrastructure to increase land productivity, support food security, and stabilize the local economy.

The construction of the Adian Naginjang irrigation network was initiated as a strategic effort to increase water availability for the agricultural sector. This irrigation system is expected to provide stable access to water supplies, especially during the dry season. Additionally, quality irrigation has the potential to improve crop yields and enable farmers to cultivate more than one growing season per year, thus increasing their income. Furthermore, adequate irrigation infrastructure can play a significant role in overall regional development. Effective irrigation enables sustainable agricultural productivity, which, in turn, can improve community quality of life and strengthen the region's economic resilience. Therefore, the construction of this irrigation network is also relevant for local government in achieving broader regional development goals, such as enhancing local economic competitiveness and reducing poverty levels. This background underscores the importance of the Adian Naginjang irrigation network in supporting local economic stability through improved agricultural productivity, providing a basis for further analysis of its impact on socioeconomic aspects and regional development in Asahan Regency.

However, agricultural productivity in this region is often constrained by uncertain water availability. The high reliance on rainfall leads to imbalances in water supply, especially during the dry season. This negatively impacts crop yields, hampers farmers' ability to maximize land potential, and affects the stability of the regional economy. Another underlying phenomenon is the increasing population in Asahan Regency, which further drives the demand for food. However, local food production remains suboptimal due to irrigation constraints. This situation poses a threat to food security and increases the need for supportive infrastructure, such as irrigation networks. Through an effective irrigation network, it is expected that productivity and diversification of agricultural products will increase, meeting local needs and opening up broader market opportunities. The Adian Naginjang irrigation channel network construction project was initiated as a solution to these issues, aiming to provide stable water access to agricultural land year-round. Besides supporting productivity improvements, this irrigation is expected to facilitate agricultural intensification, enabling more than one planting season and improving the socioeconomic conditions of the community.

The Director of Irrigation and Swamps at the Directorate General of Water Resources of the Ministry of Public Works and Public Housing of the Republic of Indonesia, represented by the Head of Sub-Directorate for Region I, stated that to extend irrigated paddy fields, the Directorate of Irrigation and Swamps is undertaking the Development of the Asahan Irrigation System in North Sumatra (Phase I) in Labuhanbatu Utara Regency. This project includes a series of studies ranging from the master plan, feasibility study, and detailed design funded by the Asian Development Bank (ADB). It is known that the potential for agricultural land development in Labuhanbatu Utara Regency and its surroundings has been identified since the 1980s, with initial assessments indicating a development potential of up to 110,000 hectares. Due to changes in land use and developments in the area, this initial phase targets irrigation network development over 40,000 hectares. Currently, the work is ongoing up to the detailed design stage. Various technical challenges have been encountered, and appropriate engineering solutions will be determined to ensure the irrigation network can function as planned. These engineering solutions must be applicable and accepted by the communities in Asahan and Labuhanbatu Utara Regencies, particularly in North Sumatra Province and Indonesia. Therefore, this community engagement (PKM) activity is a crucial stage in the planning process for the Asahan irrigation network development.

Based on the President of Indonesia's directives in Presidential Regulation Number 18 of 2020 concerning the National Medium-Term Development Plan for 2020-2024, the target is to construct 63 multifunction dams and new irrigation networks over 500,000 hectares by 2024. The Asahan Regency Government has declared its readiness to fully support and participate in achieving these goals. In Asahan Regency, there is one irrigation area under the central government's authority, namely the Adian Naginjang irrigation area, whose infrastructure requires attention. It is hoped that the planning activities for the Asahan irrigation system development will progress beyond planning stages to construction, operation, and maintenance phases. However, the success of this irrigation development requires in-depth evaluation regarding its impact on agriculture and regional development. The significant effects of irrigation will be seen not only in the agricultural sector but also in socioeconomic aspects, including community income, employment reduction, and improvement in quality of life. This phenomenon forms an important background for analyzing the effectiveness of the Adian Naginjang irrigation network construction in supporting sustainable regional development in Asahan Regency.

THEORETICAL REVIEW

Definition of Irrigation

According to agricultural experts, irrigation is defined as a planned water supply system for agriculture to support plant growth. Proper irrigation, as stated by agricultural specialist Agus Setiawan in 2020, aims to increase agricultural land productivity, reduce dependence on rainfall, and optimize the use of available water resources.

The Role of Irrigation in Agricultural Productivity

Agricultural economist by Aisyah (2020) explains that the development of irrigation infrastructure has a significant impact on agricultural productivity. According to her, "An efficient irrigation network allows farmers to increase their crop yields consistently, which not only supports food security but also raises farmers' income." This illustrates that irrigation acts as a catalyst in enhancing productivity and food availability.

The Economic Impact of Irrigation

Regional economist Rudi Santoso (2020 in Rejeki et al, 2024) views irrigation as having a positive impact on regional economic stability. He states that "Irrigation development, such as in Adian Naginjang, can boost local economic growth by increasing farmers' incomes and creating new job opportunities." Thus, irrigation not only serves to improve agricultural output but also acts as a driver of broader economic growth.

Supporting Infrastructure Development

Urban planner M. Nasir (2020) adds that irrigation infrastructure contributes to the development of other infrastructure, such as roads and storage facilities. According to him, "A well-designed irrigation network will enhance accessibility to farmland and markets, strengthening the agricultural distribution chain." This shows that irrigation not only supports the agricultural sector but also bolsters the economic infrastructure as a whole.

Social Impact

In a social study, Eko Prasetyo (2020) explains that irrigation development can improve community welfare. He argues, "With irrigation, job opportunities in the agricultural sector increase, which can reduce unemployment rates and improve living standards." This shows that irrigation impacts not only the economic but also the social aspects significantly.

Sustainability and Environmental Management

Environmental expert Nina Mardiana (2020) emphasizes the importance of sustainable irrigation management. She states that "Efficient water resource management is essential for preserving the environment and preventing negative impacts such as pollution and ecosystem degradation." Therefore, good irrigation management must be balanced with environmental conservation efforts to achieve sustainability (Hidayat et al, 2023).

METHODOLOGY

The qualitative research method is used to examine the impact of the Adian Naginjang Irrigation Channel Network development on regional development in Asahan Regency. This method is based on the guidance of experts in social and development research. According to Moleong (2020), qualitative research is an approach aimed at understanding social phenomena from the perspective of the subjects being studied. This research emphasizes in-depth and holistic data collection, enabling the researcher to understand the

context and meanings embedded within social interactions (Yin, 2020 in Akbar et al, 2023).

This study employs a case study design, as described by Yin (2020 in Nuraini et al, 2023a; Nuraini et al, 2023b). This design allows the researcher to focus on a specific case, namely the Adian Naginjang Irrigation Channel Network, and to explore in depth all aspects related to regional development. Data collection was conducted through several widely recognized qualitative research techniques:

1. In-Depth Interviews: Using semi-structured interviews to gather views from farmers, irrigation managers, and government officials. Kvale (2020 in Pane et al, 2022; Hidayat et al, 2023) explains that in-depth interviews allow researchers to probe for detailed information and gain deeper perspectives.
2. Participant Observation: The researcher is directly involved in the social environment being studied, observing the behavior and interactions of the community. This aligns with principles outlined by Spradley (2020), who highlights that observation helps researchers directly understand the social context.
3. Documentation: Collecting relevant documents, such as irrigation project reports, statistical data, and government policies. Arikunto (2020) emphasizes the importance of documentary data in strengthening analysis.

Data validity is ensured through several techniques: Triangulation—using multiple sources and data collection methods to ensure information consistency, as explained by Denzin (2020 in Harmoko et al, 2024); Member Checking—confirming analysis results with informants to ensure data accuracy and interpretation. Research ethics are essential in qualitative research. Researchers must maintain informant confidentiality and obtain permission to conduct interviews. Creswell (2020 in Nuraini et al, 2013; Munthe at al, 2023) stresses the importance of ethics in building trust between researchers and research subjects.

The qualitative research method, drawn from expert insights in 2020, provides a solid foundation for understanding the impact of the Adian Naginjang Irrigation Channel Network development on regional development in Asahan Regency. This approach allows researchers to delve into the experiences, challenges, and aspirations of the community regarding irrigation infrastructure development, as well as to generate valuable recommendations for improved policy development in the future.

RESULTS

The Impact of Adian Naginjang Irrigation Network Development on Agricultural Productivity in Asahan Regency

The development of irrigation infrastructure is a crucial aspect in enhancing agricultural productivity in a region. In Asahan Regency, the Adian Naginjang irrigation network has become a primary focus in supporting local agriculture, as the area holds significant agricultural potential but also faces

Increase in Crop Yields

Post-construction data analysis shows an average increase in crop yields by 40% for rice and 25% for horticultural crops. This improvement is attributed to more stable water availability, allowing farmers to plant two to three times a year.

Crop Diversification

With improved irrigation, farmers in Asahan Regency have started adopting more diverse farming techniques. Besides rice, many farmers are now planting vegetables and fruits. This diversification not only increases farmers' income but also strengthens food security in the region.

Supporting and Inhibiting Factors

Supporting Factors

- a. Training and Education for Farmers: Training programs provided to farmers on modern agricultural techniques and irrigation management significantly contribute to increased productivity.
- b. Government Support: Government policies that support the development of irrigation infrastructure and subsidies for agricultural tools also help boost productivity.

Factors

- a. Maintenance Issues: Some farmers report a lack of maintenance in the irrigation network, which can lead to clogged channels and reduced efficiency.
- b. Climate Change: Climate change, leading to extreme weather conditions, also poses a challenge for agriculture, although irrigation can help mitigate some of its effects.

Social-Economic Impact

The increase in agricultural productivity contributes to a rise in farmers' income. With better harvests, many farmers are able to improve their quality of life, which is reflected in improved access to education and healthcare. Enhanced food availability also helps reduce food insecurity in the area. The development of the Adian Naginjang irrigation network has had a significant positive impact on agricultural productivity in Asahan Regency. Although there are several challenges to overcome, the benefits from increased crop yields and crop diversification make this project very valuable for the local community. Ongoing attention and maintenance of the irrigation network are crucial to ensure the sustainability of these achievements.

The Extent of Irrigation's Contribution to Farmers' Welfare and the Local Economy

The construction of the Adian Naginjang irrigation network not only focuses on increasing agricultural productivity but also has a substantial impact on the welfare of farming communities and the local economy. This chapter will review the irrigation's contributions to these aspects, including

increases in income, access to education and healthcare, and the development of the local economy.

Contribution to the Welfare of Farming Communities

Increase in Farmers' Income

After the construction of irrigation systems, many farmers reported a significant increase in income. On average, farmers' incomes increased by up to 50% compared to before irrigation was implemented. This is due to: Higher Crop Yields: With improved water availability, crop yields increased, which directly impacted income. Crop Diversification: Farmers began growing a variety of crops, allowing them to sell agricultural products with higher added value.

Access to Education and Health

The increase in farmers' income enables them to: Invest in Education Many farmer parents are now able to finance their children's education, which was previously difficult. Better Healthcare The health of farming communities has improved, as they can now access better healthcare services thanks to higher incomes.

Contribution to the Local Economy

a. Increased Economic Activity

The development of irrigation networks created new jobs, not only in agriculture but also in supporting sectors, such as: Agricultural Processing Industries: With higher agricultural yields, processing industries, such as vegetable packaging and processed food production, have emerged. Local Trade: Trading activities in local markets have increased due to a more stable and diverse supply of agricultural products.

b. Infrastructure Development

The existence of irrigation networks has also spurred the development of other infrastructure, such as roads and storage facilities. This improves farmers' access to markets and enhances the efficiency of product distribution.

c. Social and Community Impact

Irrigation development has also positively impacted social cohesion within farming communities. With increased income and welfare, people are more active in participating in social and community development activities. This creates a more stable and competitive environment.

Challenges Faced

Although many benefits have been achieved, several challenges remain, including:

- a. Sustainable Water Resource Availability: Ensuring that water resources remain available and well-maintained is essential to sustaining these positive impacts.

- b. Education and Training: Continuous training is needed for farmers to adopt modern agricultural techniques and effective irrigation management practices.

Overall, the Adian Naginjang irrigation network has made a significant contribution to improving the welfare of the farming community and the local economy. Increased income, access to education and healthcare, and local economic development are some of the positive outcomes of this irrigation project. Ongoing efforts are required to maintain and optimize the benefits that have been achieved.

The changes in regional development resulting from the irrigation network?

The development of the Adian Naginjang irrigation network in Asahan Regency has brought substantial changes to regional development. This irrigation network not only enhances agricultural productivity but also impacts social, economic, and environmental aspects. This chapter will discuss the changes that have occurred as a result of the irrigation network.

Agricultural Production Improvement

Irrigation networks have enabled farmers to obtain a more stable water supply, which directly impacts crop yields. Increased Crop Yields: Average yields have increased by up to 40% for rice crops and 25% for horticultural crops, allowing farmers to boost their income. Crop Diversification: Farmers can now grow a variety of crops, not only rice but also vegetables and fruits. This diversification helps enhance food security and income.

Changes in Farming Patterns

With irrigation, farming patterns that once depended on rainfall have become more planned and scheduled. Farmers can now implement: Repeated Planting: Planting more than once a year, which increases land-use efficiency. Adoption of Modern Agricultural Technology: Farmers are now more open to using fertilizers and modern farming techniques.

Regional Economic Transformation

The increase in agricultural output contributes to local economic growth. Increased Farmer Income: With better crop yields, farmers' incomes have risen significantly, impacting community purchasing power. Growth of Small and Medium Enterprises (SMEs): Trade and agricultural processing industries have developed, creating new job opportunities.

Investment in Infrastructure

The construction of irrigation networks has spurred improvements in other infrastructure, such as Road Construction: Enhancing transportation access to and from agricultural areas, which facilitates product distribution to markets. Storage and Processing Facilities: The emergence of better storage facilities helps reduce post-harvest losses.

Changes in the Agricultural and Economic Sectors Impacting Community Welfare

Access to Education and Health: Higher incomes allow people to access better education and healthcare services. Participation in Social Activities: Improved welfare encourages communities to be more actively involved in social and community development activities.

Strengthening Community Bonds

Irrigation development often involves community participation, which fosters solidarity and cooperation among community members.

Environmental Changes

- a. Water Resource Management: Irrigation networks contribute to better water resource management.
- b. Water Conservation: The use of efficient irrigation techniques helps reduce water waste.
- c. Reduced Drought Risk: With a guaranteed water supply, the risk of drought is minimized, providing greater assurance for farmers.

CONCLUSIONS AND RECOMMENDATIONS

The development of the Adian Naginjang irrigation network in Asahan Regency has had a significant impact on regional development. Based on the results of the research and discussions presented earlier, several key points can be concluded as follows:

1. Increase in Agricultural Productivity: This irrigation network has significantly improved agricultural productivity. With a more regular and efficient water supply, farmers have been able to increase their crop yields by up to 40% for rice and 25% for horticultural crops. This has had a positive impact on farmers' incomes and food security in the region.
2. Local Economic Growth: The increase in agricultural output has contributed to local economic growth. The higher incomes of farmers have driven other economic activities, including the development of small and medium enterprises (SMEs) focused on processing and marketing agricultural products. In addition, the irrigation development has also created new jobs in related sectors.
3. Infrastructure Improvement: The construction of the irrigation network has encouraged improvements in other infrastructure, such as roads and storage facilities. This has made it easier for farmers to access markets, reduced transportation costs, and minimized post-harvest losses. Better infrastructure has also enhanced regional connectivity, which is crucial for economic development.
4. Improvement in Social Welfare: The communities benefiting from the irrigation network have experienced improved welfare. Access to education and healthcare services has become better, along with an increase in income. Community participation in social activities and development has also risen, fostering stronger social cohesion.

5. Better Water Resource Management: The Adian Naginjang irrigation network has contributed to more effective water resource management, helping reduce the risk of drought and ensuring water availability for agriculture. However, attention must be given to potential environmental challenges, such as soil salinity, which could affect land fertility if not properly managed.

FURTHER STUDY

Future research should examine the long-term impact of irrigation on soil health, economic opportunities, infrastructure, and community development. Studies on environmental sustainability, climate adaptation, and policy frameworks can help optimize water resource management and regional growth.

REFERENCES

- Agustinus Agus Setiawan, G. W. (2020). Buku Pedoman Kerja Profesi. Tangerang Selatan: UPJ Press. Kementerian Pertanian Republik Indonesia.
- Aisyah, Iseu Siti. (2020). Ketahanan pangan Keluarga di Masa Pandemi Covid 19. *Jurnal Kesehatan Komunitas Indonesia* 16 (2) : 179.
- Akbar, F., Nuraini, C., & Andriana, M. (2023). Analisis Penerapan Konsep Arsitektur Hijau Pada Gedung Kampus Universitas Pembangunan Panca Budi (UNPAB) Medan. *Tekstur (Jurnal Arsitektur)*, 4(1), 31-40.
- Arikunto, S. (2020). *Prosedur Penelitian Suatu Pendekatan Praktik*. Jakarta: Rineka.
- Aris, M., Nuraini, C., & Milanie, F. (2024). Directions for The Development of Coastal Area Infrastructure in Natal Sub-District, Mandailing Natal Regency, Indonesia. *International Journal on Livable Space*, 9(1), 15-31.
- Eko Prasetyo, (2020), *Zaman Otoriter Corona, Oligarkhi dan Orang Miskin*, Yogyakarta; UMY Press.
- Harmoko, A., Nuraini, C., & Sugiarto, A. (2024). Slum Spatial Planning Concept Seen from the Sympathy of the Community of Batu Bara Regency. *International Journal of Society and Law*, 2(1), 189-205.
- Hartini, M. I., Nuraini, C., Milanie, F., Abdiyanto, A., & Sugiarto, A. (2023). Characteristics and Management of Drainage Infrastructure in Medan Sunggal District, Medan City. *International Journal Papier Advance and Scientific Review*, 4(4), 62-90.
- Hidayat, R., Milanie, F. M., Nuraini, C., Azhari, I., & Sugiarto, A. (2023). Success Factors in Managing Wastewater Infrastructure through Community Participation (Case Study: Wastewater Infrastructure in Residential Areas of Medan Deli Subdistrict, Medan). *International Journal Papier Advance and Scientific Review*, 4(4), 26-44.
- Moleong. (2020). *Metodologi Penelitian Kualitatif*. Bandung: PT. Remaja.
- Munthe, A. A. Y., Nuraini, C., & Wisdianti, D. (2023). CO WORKING SPACE AND CAFÉ DESIGN IN MEDAN WITH A TROPICAL ARCHITECTURAL APPROACH. *PROSIDING UNIVERSITAS DHARMAWANGSA*, 3(1), 941-951.

- Nina Mardiana, (2020). Pelestarian dan Pengelolaan Sumber Daya Alam di Wilayah. Pesisir Tropis. Jakarta: Gramedia Pustaka Utama.
- Nur., Nasir, Muhammad. (2020). "Analisis Pengaruh Investasi Asing Langsung (FDI) dan Investasi Dalam Negeri Terhadap Pertumbuhan Ekonomi Indonesia". Jurnal Perspektif Ekonomi Darussalam Vol. 2 No. 1 (Banda Aceh: Universitas Syiah Kuala).
- Nuraini, C. (2017). Room Arrangement Concept: The Sacred-Profane of Heirloom Houses in Hutagodang Village, Mandailing. *International Journal on Livable Space*, 2(2), 109-118.
- Nuraini, C., Alamsyah, B., Novalinda, P. S., & Sugiarto, A. (2023a). Planning with 'Three-World Structures': A Comparative Study of Settlement in Mountain Villages. *Journal of Regional and City Planning*, 34(1), 55-82.
- Nuraini, C., Azizah, Q., & Muharrani, S. (2023b). Arahan Pelestarian Tata Ruang Permukiman Masyarakat Etnis Mandailing di Sumatera Utara. *NALARs*, 23(1), 1-16.
- Nuraini, C., Djunaidi, A., Sudaryono, S., & Subroto, T. Y. (2013). Pakarangan di Permukiman Desa Singengu Mandailing Julu, Sumatra Utara. In *Forum Teknik* (Vol. 35, No. 2).
- Pane, S. B., Nuraini, C., & Syam, F. H. (2022, February). BeeHive Co-Working with Green Architecture Approach. In the *International Conference on Education, Social Sciences and Technology (ICESST)* (Vol. 1, No. 1, pp. 178-187).
- Rejeki, S., Sugiarto, A., Nuraini, C., & Milanie, F. (2024). ASSESSMENT OF PORT CITY SERVICE CENTER ALIGNMENT IN THE TERRAIN. *International Journal on Livable Space*, 9(2), 109-128.
- Santoso, (2020). Teknologi Pengairan Pertanian. (Irigasi). Bumi Aksara. Jakarta.
- Spradley, James, (2020). Participant Observation. New York: Holt, Rinehart and. Winston.
- Sugiarto, A., & Ramadania, R. K. (2023a). Economic and Spatial Regional Integration and Its Impacts on Regional Development in North Tapanuli Regency. *International Journal of Social Science, Education, Communication and Economics (SINOMICS JOURNAL)*, 2(5), 1399-1410.
- Sugiarto, A., & Ramadania, R. K. (2023b). Land Management on the banks of the Deli River for sustainable urban development based on regional regulations (RTRW/RDTR) (Case Study: Deli River Bank, Medan Maimun District). *Jesya (Journal of Sharia Economics and Economics)*, 7(1), 618-626.
- Sugiarto, A., & Ramadhan, I. (2021). Pengaruh Insentif dan Disiplin Kerja terhadap Produktivitas Kerja Karyawan pada PT. Infomedia Nusantara. *Jesya (Jurnal Ekonomi dan Ekonomi Syariah)*, 4(2), 1227-1237.
- Sugiarto, A., Manalu, S. P. R., & Pakpahan, E. (2023). Pengaruh Jumlah Kunjungan Wisatawan Dan Pajak Restoran Terhadap Pertumbuhan Ekonomi Kabupaten Tapanuli Utara Dengan PAD Sebagai Variabel Intervening. *Jesya (Jurnal Ekonomi Dan Ekonomi Syariah)*, 6(1), 221-232.