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Poverty Reduction Through Adaptive Social Protection and Spatial Poverty Model in Labuan Bajo, Indonesia's National Strategic Tourism Areas

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Abstract: Despite Indonesia's significant economic progress, certain regions, such as West Manggarai Regency in East Nusa Tenggara, continue to face persistent poverty challenges. While strategic tourism initiatives in Labuan Bajo have spurred regional development, the benefits have not reached local communities equitably, highlighting a disconnect between economic growth and community well-being. Addressing this gap requires an integrated approach that links social protection, disaster risk reduction, climate adaptation, and economic diversification. This paper proposes an adaptive social protection (ASP) framework that aims to increase the resilience of vulnerable populations by integrating social protection systems with disaster preparedness and sustainable economic strategies. The research critically examines the Regional Medium-Term Development Plan (RPJMD) of Kabupaten Manggarai Barat (2021–2026), identifying existing policy gaps and opportunities for improvement. Using a mixed-methods approach, this study used cluster mapping and geographically weighted regression analysis to model and visualise poverty distribution alongside infrastructure conditions. These findings will inform the design of a targeted ASP programme to reduce poverty and build resilience to economic and environmental shocks. By aligning with sustainable development principles, the proposed framework addresses the dual goals of poverty reduction and disaster risk reduction. This study provides actionable recommendations for local governments to strengthen social protection mechanisms, promote inclusive economic growth, and ensure equitable distribution of tourism benefits. The findings provide a policy blueprint for promoting sustainable and inclusive development in West Manggarai Regency, with implications for similar contexts in other regions.

Keywords: adaptive social protection; poverty reduction; national tourism; Labuan Bajo

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Academic Editors: Mattia Bertin and Edward J Blakely

Received: 24 November 2024
Revised: 2 January 2025
Accepted: 7 January 2025
Published: 13 January 2025

Citation: Gai, A.; Ernan, R.; Fauzi, A.; Barus, B.; Putra, D. Poverty Reduction Through Adaptive Social Protection and Spatial Poverty Model in Labuan Bajo, Indonesia's National Strategic Tourism Areas. *Sustainability* **2025**, *17*, 555. https://doi.org/10.3390/su17020555

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1. Introduction

1.1. Poverty in Indonesia

Poverty in Indonesia is a multifaceted issue despite the country's notable economic advancement over the past few decades [1]. The poverty rate has declined from approximately 24% in 1999 to approximately 9.78% by 2020, indicating a noteworthy improvement. However, this overall enhancement conceals persistent disparities. Regions with higher poverty rates, mainly rural areas and those with limited access to education and healthcare,

contribute to the ongoing challenge. Furthermore, income inequality also plays a role in perpetuating poverty, with a widening gap between the rich and the poor [2].

Additionally, Indonesia's vulnerability to natural disasters and economic shocks often results in people being pushed back into poverty or their ability to climb out of poverty being constrained. Nusa Tenggara Timur (NTT) is one of Indonesia's poorest provinces, with a poverty rate significantly higher than the national average [3]. Several factors contribute to this challenging situation. Firstly, due to its numerous islands, the province's geographical isolation creates transportation and infrastructure issues that hinder economic development and access to essential services. Secondly, financial opportunities in NTT are limited, with agriculture being the primary activity. However, this is often subsistence-based and vulnerable to climate variability and natural disasters, which harm the region's economic stability. Low levels of education restrict access to better-paying jobs, which in turn exacerbates poverty. At the same time, poor health indicators, such as high rates of malnutrition and maternal and infant mortality, further entrench poverty in the region. Environmental factors like frequent droughts also negatively affect agricultural productivity, leading to unstable livelihoods.

1.2. Poverty in Labuan Bajo

The reduction of poverty in NTT necessitates the implementation of comprehensive and context-specific strategies. The improvement of infrastructure and the expansion of education and healthcare services are critically important. Furthermore, fostering economic diversification and promoting sustainable tourism and other industries could drive inclusive growth and provide new opportunities for residents. A more effective and sustainable approach to reducing poverty in NTT and across Indonesia can be achieved by considering these factors. The high poverty level in the West Manggarai Regency, which encompasses the Labuan Bajo National Priority Strategic Area in East Nusa Tenggara, Indonesia, has been a persistent challenge. Despite the region's identification as a strategic tourism zone with significant developmental potential, the socioeconomic benefits have yet to translate into substantial poverty alleviation for residents. The Regional Medium-Term Development Plan of Kabupaten Manggarai Barat (2021–2026) acknowledges the necessity for targeted initiatives to address this persistent issue. It outlines sustainable development objectives with poverty reduction as a primary focus, emphasising integrating social protection measures with broader economic strategies [4].

1.3. Adaptive Social Protection and Spatial Poverty Model for Solutions

This research proposes an adaptive social protection approach to bridge the gap between the growth of the tourism sector and the surrounding communities' financial well-being [5]. Adaptive social protection (ASP) is a holistic strategy combining traditional social protection with disaster risk reduction, climate adaptation, and emergency response measures [6]. The overarching goal is to create a system that can adapt to changing circumstances while promoting resilience among vulnerable populations. This approach can be crucial in reducing poverty, particularly in areas prone to natural disasters or economic volatility [7]. By integrating disaster risk reduction strategies, ASP anticipates and mitigates the effects of natural disasters and other shocks that can cause sudden surges in poverty [1,8]. This integration involves developing early warning systems, establishing emergency response plans, and implementing community-based risk management practices. The proactive approach helps minimise the impact of disasters and reduces the likelihood of people falling into poverty [9,10].

Adaptive social protection offers a comprehensive and flexible framework for poverty reduction, emphasising resilience, responsiveness, and sustainability [9,11]. By addressing

chronic and shock-induced poverty, ASP can significantly reduce poverty and enhance vulnerable populations' well-being [12]. The objective is to develop a framework for poverty management that aligns with sustainable development principles [12,13]. The utilisation of a poverty typology, which categorises impoverished areas based on infrastructure conditions, enables this study to develop a model that identifies specific needs and provides a tailored response [14]. Furthermore, geographic weighted regression analysis allows for a spatial understanding of poverty distribution, facilitating targeted interventions [15]. The objective of this model is to serve as a foundation for developing effective policies and programs that aim to reduce poverty and enhance social protection within the Labuan Bajo National Priority Strategic Area. The findings of the research are anticipated to contribute to recommendations for sustainable poverty management, which will, in turn, inform the development plan and other relevant local regulations.

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2. Methods

This research project addresses critical issues identified in the study location, such as poverty, livelihoods, and national strategic areas in the West Manggarai region, focusing on Labuan Bajo. The primary objective is to develop a poverty reduction framework based on these issues. To accomplish this, it is imperative to conduct a series of analyses, including cluster mapping for poverty distribution, geographically weighted regression for poverty analysis, and infrastructure correlation and complementary analysis to pinpoint suitable programs for poverty reduction through adaptive social protection (ASP). The ASP approach encompasses three main programs aimed at poverty reduction: fostering local community participation, fostering collaboration between national and local entities, promoting tourism expansion, and boosting local production [16,17]. The findings of these analyses suggest that the envisioned outcome will be a poverty reduction framework that leverages the concept of adaptive social protection to alleviate poverty in West Manggarai Regency, with a specific emphasis on the Labuan Bajo area.

The research focuses on Kabupaten Manggarai Barat, with an in-depth analysis of the Labuan Bajo area. The study aims to address poverty issues in the region by examining socio-economic conditions and identifying opportunities for collaboration between local government, community stakeholders, and tourism stakeholders in Labuan Bajo. The aim is to develop a comprehensive poverty reduction programme that capitalises on the area's potential as a National Tourism Strategic Area.

The map Figure 1 shows Kabupaten Manggarai Barat, located in the western part of the island of Flores, in the province of Nusa Tenggara Timur. The highlighted area (circled in red) represents Labuan Bajo and its surrounding regions, highlighting its designation as a National Tourism Strategic Area. The map also shows neighbouring islands and administrative boundaries within the Nusa Tenggara region, providing a geographical context for the focus area of the study.



Figure 1. National Tourism Strategic Area Manggarai Barat.

2.1. Cluster Map

The cluster mapping analysis method identifies poverty typology and delineates the stages and programs for addressing poverty. Generating a cluster map requires georeferenced data encompassing geographic coordinates (e.g., latitude and longitude) and other pertinent information (e.g., population, crime rates, or sales data). The data must be meticulously organised and error-free to ensure precise analysis. The resultant map depicts the geographic area with color-coded or symbol-based representations of clusters. These visualisations facilitate the identification of patterns, trends, and outliers, offering insights into the spatial distribution of the data [14].

Upon creating the cluster map and identifying patterns, the subsequent step involves interpreting the results and determining appropriate actions. This may entail further statistical analysis, on-site research, or policy adjustments. The insights from cluster mapping can inform resource allocation, planning, and decision making, enabling stakeholders to address the identified trends or issues effectively [18,19].

2.2. Geographic Weighted Regression

Geographically weighted regression (GWR) is a spatial regression technique that generates individual regression models for each feature within a dataset. In contrast to global regression models that assume consistent relationships, GWR accommodates spatial variances by estimating local regression coefficients [20]. It utilises proximity-based weighting for neighbouring features, enabling nearby features to exert a more substantial influence on the regional model. This study utilised geographic weighted regression analysis to explore the correlation between poverty and the distribution of activity centres and infrastructure [21].

A geographically weighted regression was conducted to investigate the impact of the condition and distribution of facilities and infrastructure in West Manggarai on poverty. The insights from this analysis were compared with those derived from the poverty cluster map [22,23].

The use of geographically weighted regression (GWR) in this research enhances the ability to capture and analyse the spatial variability of poverty across West Manggarai Regency. Unlike traditional regression models that assume uniform relationships between poverty and influencing factors, GWR allows for localised analysis, revealing how infrastructure and economic growth from tourism uniquely affect different areas. This is crucial to understanding why tourism-driven development in Labuan Bajo has not benefited

surrounding communities equitably. By identifying poverty hotspots and their specific infrastructure deficits, the GWR provides a granular view of the factors contributing to poverty, giving policymakers insight into the localised nature of poverty and the underlying spatial disparities.

GWR plays a critical role in integrating poverty mapping with infrastructure conditions to inform the development of an adaptive social protection (ASP) framework. The analysis highlights areas where poor infrastructure correlates strongly with high poverty rates, enabling targeted interventions in line with the objectives of the Regional Medium-Term Development Plan (RPJMD). This localised understanding supports disaster risk reduction (DRR) and climate adaptation by identifying vulnerable regions in need of strengthened social protection systems. GWR empowers local governments to design equitable, evidence-based policies to ensure that economic growth and tourism development translate into sustainable poverty reduction and resilience building for communities in West Manggarai.

2.3. Complementary Analysis

Complementary analysis is a method that integrates various analytical approaches to offer a more thorough comprehension of intricate issues. This involves utilising diverse techniques, data sources, and viewpoints to gain deeper insights, mitigate biases, and corroborate findings.

This approach is precious when addressing multifaceted problems necessitating quantitative and qualitative analysis. Complementary analysis is employed to identify the most suitable program for addressing poverty [3]. The program is intended to serve as a recommendation for the sustainable management of poverty in the development plan and other pertinent local regulations. This study utilised complementary analysis to pinpoint programs aligned with the specific needs and challenges of poverty in West Manggarai.

The framework Figure 2 for the spatial poverty model outlines a systematic approach to addressing poverty in West Manggarai, with a focus on Labuan Bajo as a national strategic area. It begins by identifying key problem issues such as poverty, livelihoods, and tourism-related development. Through methods like cluster mapping, geographically weighted regression (GWR), and complementary analysis, the model generates outputs that identify poverty clusters, assesses the correlation between poverty and infrastructure, and develops adaptive social protection strategies. The goal is to align Labuan Bajo's status as a national tourism destination with targeted social protection measures, including cash transfers, public works, disaster risk insurance, and diversified livelihoods. This integrated approach informs policy recommendations and resource allocation, driving sustainable poverty reduction programs and fostering inclusive development.

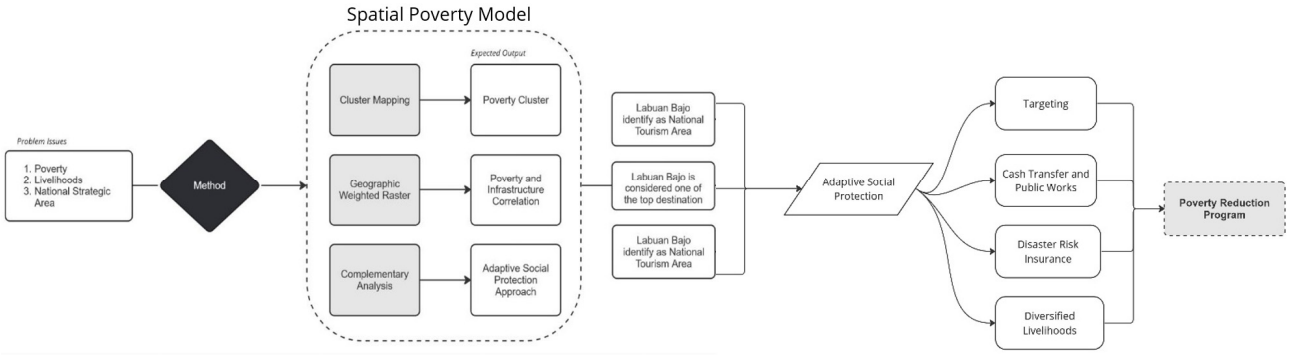


Figure 2. Research framework.

This methodology is set apart by incorporating ASP, which links social protection with DRR, livelihood diversification, and economic resilience. This dynamic framework allows for responsive interventions that adapt to changing socio-economic and environmental conditions, ensuring long-term poverty reduction. Unlike static models, the ASP approach not only alleviates poverty but also strengthens the community's ability to withstand economic and environmental shocks. This holistic strategy is consistent with sustainable development goals by promoting equitable growth, reducing vulnerability, and enhancing resilience at local and regional levels.

3. Results

3.1. Spatial Poverty Model

3.1.1. Cluster Poverty

The cluster analysis conducted in West Manggarai reveals significant differences in poverty levels across districts, which are categorised into five different classes. The districts of Lembor Selatan and Sano Nggoang fall into the 'very low' poverty category, indicating relatively better socio-economic conditions and lower poverty rates. These districts have fewer constraints in terms of access to basic services, infrastructure, and economic opportunities. Mbeliling District falls into the 'low' poverty category, indicating slightly higher poverty levels, but still reflecting manageable conditions compared to other regions. Table 1 and Figure 3 illustrate the different levels of poverty even between neighbouring districts.

Table 1. Poverty cluster.

Bajo District	Poverty Population	Poverty Rank
Lembor Selatan	1662	Very Low
Sano Nggoang	1659	
Mbeliling	2020	Low
Macang Pacar	2883	Moderate
Boleng	2921	High
Komodo	3998	Very High

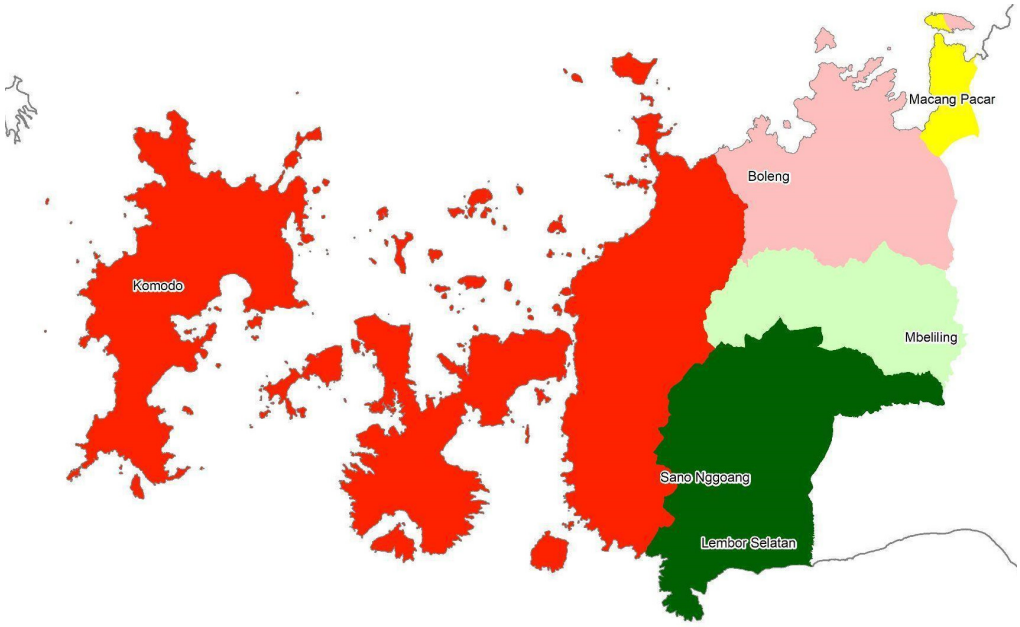


Figure 3. Poverty map.

Macang Pacar district falls into the 'moderate' category, representing a transitional zone where poverty remains a concern but is not as severe as in other parts of the region. This area could benefit from targeted interventions that address underlying economic vulnerabilities and infrastructure gaps. Boleng district, classified as 'high' poverty, reflects more pronounced economic difficulties, possibly due to limited employment opportunities, inadequate infrastructure, and a greater reliance on subsistence-based livelihoods. This classification underscores the need for comprehensive development efforts to uplift the communities within this district.

The district of Komodo stands out as the most worrying, falling into the 'very high' poverty category. Despite being a focal point for tourism and a prominent national strategic area, the economic benefits of tourism have not sufficiently translated into poverty alleviation for local people. This discrepancy highlights the limitations of tourism-led growth in addressing deep-rooted poverty and points to the need for inclusive development strategies that go beyond the tourism sector. Ensuring that local communities benefit from tourism revenues and employment opportunities is crucial for poverty reduction in this area.

The poverty cluster summary table provides a structured comparison of poverty populations and ranks across districts. Using colour-coded classifications, the table provides an intuitive visualisation of poverty distribution, facilitating the identification of areas requiring urgent policy intervention. This structured approach facilitates data-driven decision making and resource allocation, ensuring that development efforts are targeted at the most vulnerable communities.

The accompanying poverty map provides a spatial representation of the distribution of poverty, reinforcing the findings of the cluster analysis. The stark contrast between districts vividly illustrates the disparities in poverty levels, with the high poverty rates of Komodo District standing out. This visual representation serves as an important tool for policymakers, enabling them to prioritise poverty reduction efforts and design geographically targeted interventions. The analysis highlights the importance of addressing the underlying factors that contribute to poverty, such as limited economic diversification, inadequate social protection, and insufficient access to quality education and healthcare.

3.1.2. Infrastructure Condition

The analysis of infrastructure coverage in West Manggarai provides critical insights into the spatial distribution of essential services, including education, health, and communication facilities. The results show that health services have the most limited coverage, highlighting the urgent need for expanded health infrastructure. Communication facilities, while present, are unevenly distributed across the region, resulting in gaps in service accessibility. In contrast, school infrastructure is more evenly distributed, suggesting relatively better access to education services across districts.

The disparity in infrastructure coverage highlights significant inequalities in service provision, with certain areas being underserved, particularly in the health and communications sectors. This uneven distribution poses challenges for residents and tourists alike and may hinder the overall development and attractiveness of the region. The lack of adequate health services is of particular concern as it affects the well-being and resilience of the community.

The maps Figure 4 highlight the concentration of school services, communication infrastructure, and health facilities, revealing areas with minimal or no access to essential services. The lower part of the figure consolidates this information, providing a comprehensive overview of the distribution of infrastructure across the region.

The analysis highlights the urgent need for strategic infrastructure development, particularly in the areas of health and communications. Addressing these gaps is essential

to promote inclusive growth and ensure that the West Manggarai National Tourism Strategic Area can effectively support both residents and the increasing number of tourists visiting the region. Improving infrastructure coverage will not only improve quality of life but also contribute to the broader economic development of West Manggarai.

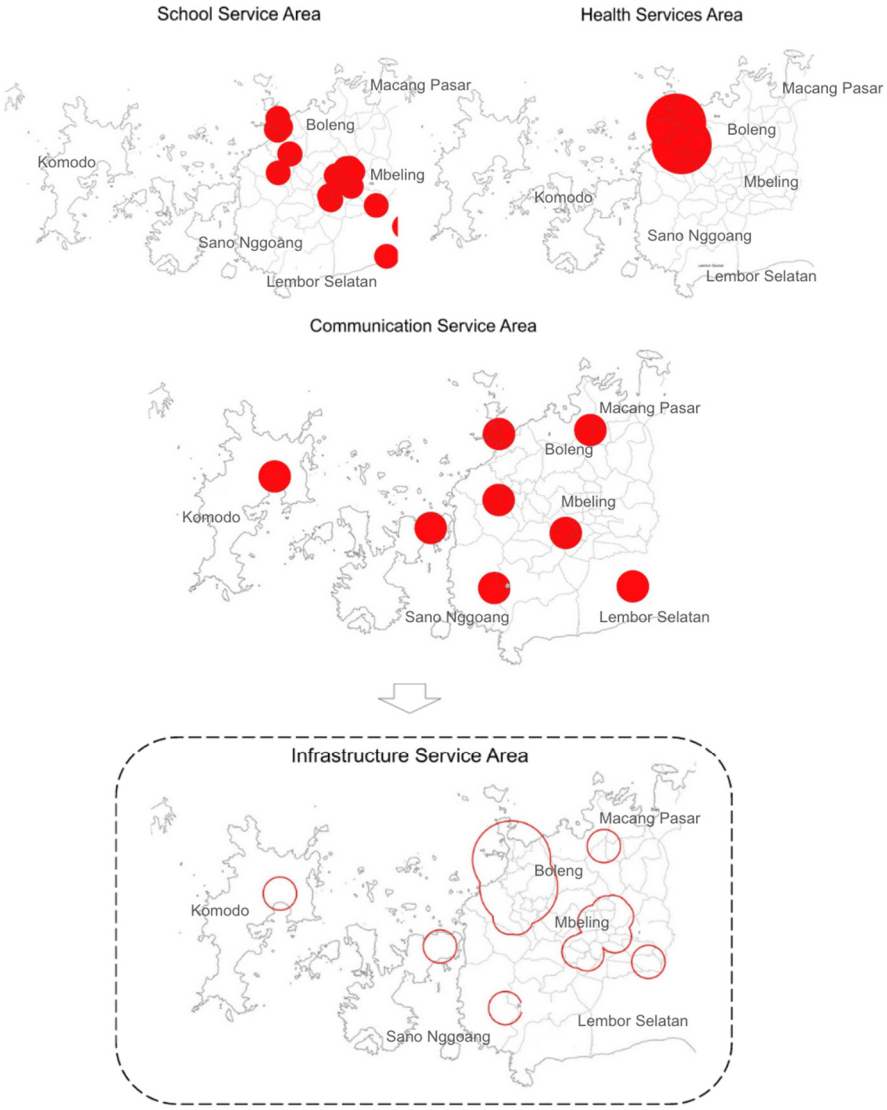


Figure 4. Infrastructure service area.

3.1.3. Geographic Weighted Regression

This study used geographically weighted regression (GWR) to examine the relationship between infrastructure distribution and poverty levels in West Manggarai. GWR extends traditional regression by incorporating spatial variability, allowing the model to identify how the relationship between poverty and infrastructure varies across different regions. This approach is particularly useful for understanding localised disparities, as poverty levels can vary significantly within small geographical areas. The dependent variable of the model is the level of poverty, while the distribution of infrastructure and related socio-economic factors serve as independent variables.

Mathematically, the GWR model expresses poverty levels as a function of spatially varying coefficients. The GWR model extends the traditional regression model by allowing the coefficients to vary spatially. The general form of the GWR model is

$$Y_i = \beta_0(u_i, v_i) + \sum_{k=1}^{m} \beta_k(u_i, v_i) X_{ki} + \epsilon_i$$

- Y_i—Dependent variable (poverty levels at location i)
- $\beta_0(u_i, v_i)$—intercept term at spatial coordinates (u_i, v_i)
- $\beta_k(u_i, v_i)$—regression coefficients that vary across space
- X_{ki}—independent variables (infrastructure levels, etc.)
- ϵ_i—Error term
- (u_i, v_i)—spatial coordinates of observation i

Geographically weighted regression (GWR) analysis provides valuable insights into the relationship between infrastructure services and poverty levels in West Manggarai. By using infrastructure distribution and poverty rates as primary variables, the GWR method effectively captures spatial variability within the study area. A notable result is the model's high R^2 value of 0.92, indicating that 92% of the variation in poverty levels can be explained by the independent variables used in the analysis. This high level of accuracy underlines the robustness and predictive reliability of the model in identifying patterns of poverty in relation to the distribution of infrastructure.

The series of maps shown in Figure 5 provide a visual representation of key findings from the GWR analysis. The 'GWR Observed' map highlights the spatial distribution of poverty, showing significant variation between wards. The 'GWR Condition' map addresses multicollinearity concerns by highlighting areas with values between 7.1 and 7.7, suggesting regions where overlapping variables may be influencing the analysis. The 'GWR Intercept' map, with a value of 8.3, reflects the degree to which the distribution of infrastructure affects poverty rates, providing insight into the baseline levels of poverty in different areas.

In addition, the 'GWR Local R^2' map highlights localised variations in model performance, highlighting areas where the regression model predicts poverty levels most accurately. This localised approach allows for a more nuanced understanding of how infrastructure affects poverty in different regions. The 'GWR Predicted' map consolidates the primary analysis by visually representing the spatial correlation between infrastructure services and poverty, further reinforcing the importance of infrastructure in addressing poverty inequalities.

The analysis shows that the distribution of infrastructure plays a crucial role in shaping poverty levels, particularly in strategic tourism areas such as West Manggarai. Districts such as Komodo, despite their economic potential, have higher poverty rates due to inadequate infrastructure coverage. This finding underscores the need for targeted infrastructure development to bridge gaps and promote inclusive economic growth.

The GWR analysis shows that addressing infrastructure deficits is essential for poverty reduction in West Manggarai. The results provide a clear direction for policy makers, emphasising the importance of expanding infrastructure services in areas with high poverty rates. By aligning development efforts with the spatial patterns identified in this study, West Manggarai can achieve more equitable growth and improve the well-being of its residents.

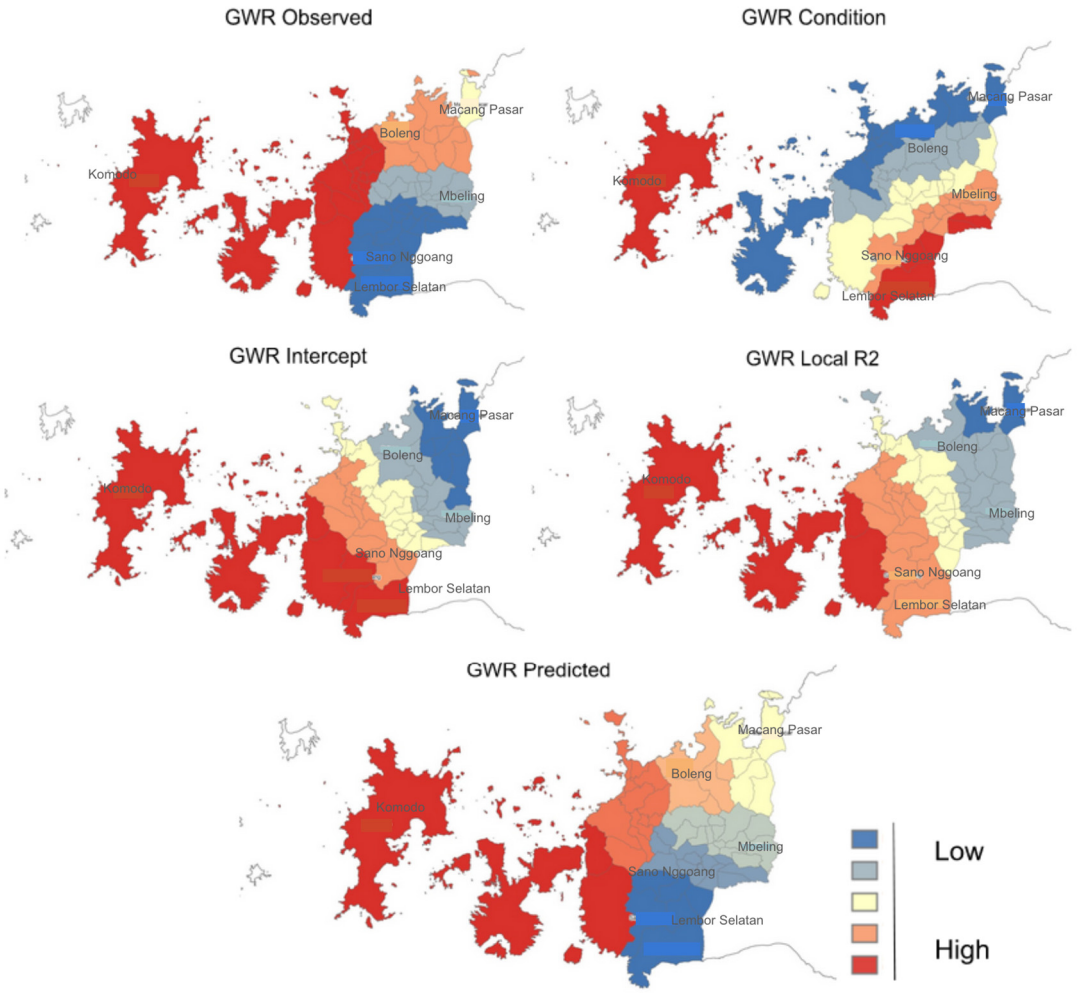


Figure 5. Geographic weighted regression.

3.2. Poverty Reduction Framework

The poverty reduction framework described in this section emphasises the critical role of adaptive social protection as a holistic poverty reduction strategy in West Manggarai, with a particular focus on the tourism-driven economy of Labuan Bajo. This integrated approach weaves together multiple elements, including targeted support to vulnerable populations, the implementation of cash transfers and public works programmes, the provision of disaster risk insurance, and the promotion of diverse livelihood opportunities. By addressing both immediate vulnerabilities and promoting long-term resilience, the framework aims to create sustainable economic stability for communities struggling with poverty.

The diagram in Figure 6 visually illustrates the interrelated components of this framework, showing how poverty reduction initiatives are aligned with national strategic tourism objectives, local capacity building, and the identification of livelihood gaps. Adaptive social protection is at the heart of this system, serving as a conduit through which key initiatives—such as cash transfers, insurance-based risk mitigation, and livelihood diversification—are integrated into broader poverty reduction programmes.

Incorporating disaster risk insurance into the framework recognises the region's exposure to environmental hazards that can exacerbate poverty and disrupt livelihoods. Similarly, the emphasis on livelihood diversification reduces dependence on single sources of income, thereby promoting economic resilience and expanding opportunities for local com-

munities. These initiatives are closely aligned with national tourism development strategies, ensuring that poverty reduction is an integral part of the broader economic agenda.

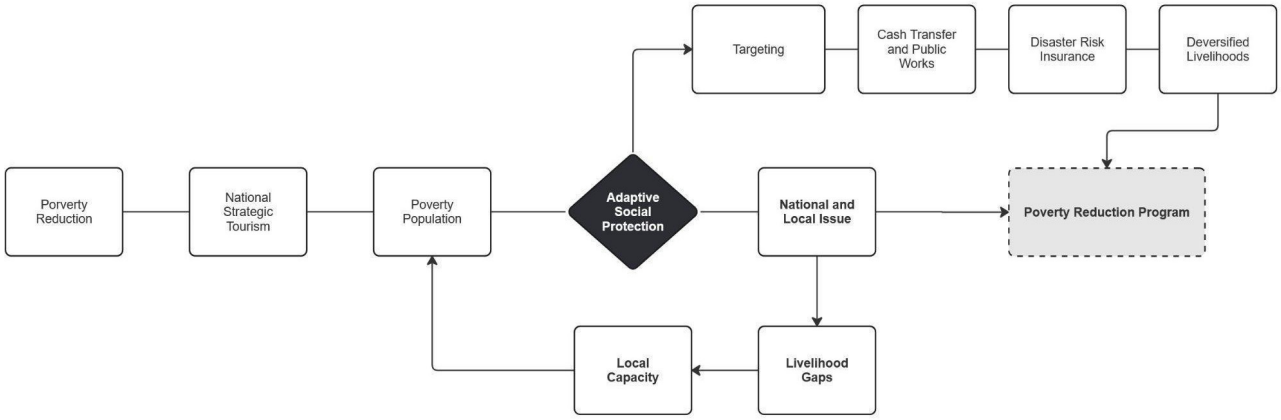


Figure 6. Poverty reduction framework.

Programmes arising from this framework are designed not only to alleviate poverty in the short term but also to foster long-term stability by building local capacity and bridging livelihood gaps. By promoting inclusive growth, the framework supports equitable development, ensuring that the economic benefits generated by Labuan Bajo's expanding tourism sector are shared more equitably among West Manggarai's communities.

The poverty reduction framework presents a comprehensive and multifaceted solution, using adaptive social protection to address poverty from multiple angles. It emphasises the need for localised interventions that respond to specific community needs and build resilience and economic security, while contributing to broader regional and national development goals.

4. Discussion

4.1. Poverty and National Tourism Labuan Bajo

Despite the increasing appeal of Labuan Bajo as a tourist destination, its residents' economic and social well-being has yet to see significant improvement. Research indicates that business owners in tourist areas earn higher average incomes than those outside such locations. However, the poverty rate in West Manggarai, where Labuan Bajo is situated, still stands at 18.01% [24]. This underscores the necessity for sustainable development that benefits the tourism industry and the local populace. Addressing the disparities and ensuring that economic growth positively impacts the entire community is crucial [25].

Moreover, the seasonal nature of tourism exacerbates poverty in the area. Employment opportunities in the tourism sector often fluctuate with visitor numbers, resulting in unstable income for residents. During periods of low tourist activity, many struggle to make ends meet, further deepening poverty within the community [26]. Additionally, the rapid development of tourism infrastructure in Labuan Bajo has yet to translate into improved living standards for all residents uniformly. While luxury resorts and hotels cater to well-off tourists, essential services such as healthcare, education, and sanitation still need to be improved in many parts of the region. This lack of crucial services disproportionately affects the poorest members of the community, perpetuating a cycle of poverty.

4.2. Poverty and Infrastructure

In Manggarai Barat being designated as a National Strategic Tourism Area (KSPN), addressing the intersection of poverty, infrastructure, and service provision requires a comprehensive and nuanced approach. The region has multifaceted challenges stemming

from poverty, leading to deficiencies in crucial areas such as healthcare, education, employment, and basic amenities. Addressing these disparities necessitates strategic interventions targeting infrastructure development and service provision [27]. Enhancing infrastructure is crucial for the socioeconomic progress within Manggarai Barat's KSPN framework [7]. Infrastructure initiatives, including transportation networks, energy accessibility, water sanitation systems, and telecommunications infrastructure, are critical in facilitating tourism and improving community welfare. By strengthening these foundational elements, the region can drive tourism-driven economic growth, foster broader socio-economic development, and alleviate poverty through improved accessibility and connectivity [17,28].

The cluster poverty mapping analysis of the Labuan Bajo national strategic area reveals five poverty-level classes, with the highest class found in the Komodo District, in the luxury area of Labuan Bajo. However, this district's affluence does not contribute to reducing poverty and improving livelihoods in the study location. Moreover, the distribution of the impoverished population is influenced by inadequate infrastructure and limited service coverage. Educational infrastructure is primarily concentrated in the Mbeliling and Boleng districts close to the city centre and port. Health infrastructure is centred in Boleng, while communication infrastructure is dispersed throughout the study area, covering only some of the region. These findings emphasise the close relationship between poverty and infrastructure, a conclusion supported by the geographic weight regression analysis results, which indicates a strong correlation coefficient of 0.92 between poverty levels and the level of infrastructure services.

4.3. Adaptive Social Protection Approach

Despite the burgeoning tourism industry, poverty persists in Labuan Bajo, Indonesia. This calls for flexible and responsive approaches to provide support to vulnerable populations. Adaptive social protection strategies hold promise in addressing poverty in the region. Targeted assistance programs, such as cash transfers and food aid, should be utilised to ensure that essential resources reach those facing the most incredible hardships [29,30]. By customising eligibility criteria to reflect the dynamic nature of poverty in Labuan Bajo, social protection programs can effectively adapt to changing circumstances and prevent vulnerable individuals and families from slipping through the cracks during times of crisis or economic instability [29,30]. Furthermore, community engagement is vital in identifying local needs and formulating solutions to address the root causes of poverty. Empowering residents to spearhead initiatives like poverty and microfinance programs fosters a sense of ownership and builds sustainable pathways out of poverty.

Adaptive social protection (ASP) enables households to prepare for, cope with, and adapt to shocks, preventing them from falling deeper into poverty. By integrating social protection, adaptation, and disaster risk reduction, ASP reduces poverty and enhances resilience in agriculture-dependent rural communities. ASP is an approach aimed at fostering resilience among poor and vulnerable households [31,32]. Targeting ASP involves identifying intervention areas and beneficiaries based on poverty incidence and vulnerability to natural disasters in key tourism areas. This includes selecting cash transfer programs and public works initiatives responsive to climate change and disasters. ASP also promotes insurance against various disaster risks and encourages the development of diversified and resilient livelihood activities [33].

4.4. Poverty Reduction Program

By incorporating these components into a holistic approach, an adaptive social protection program can adeptly tackle poverty's intricate and ever-changing nature, empowering at-risk communities to forge enduring livelihoods and enhance their overall welfare in the

long run [5,34]. Poverty reduction initiatives encompass the four primary facets in Table 2 for adaptive social protection (ASP) programmes.

Table 2. Adaptive social protection for poverty reduction.

Adaptive Social Protection (ASP)		Program
Targeting	Identification Vulnerable groups	Precise targeting ensures that assistance reaches those most in need. Identifying vulnerable households based on criteria (e.g., income, assets, location).
Cash transfer and public works	Direct assistance Impact	Providing cash to eligible households. It helps meet basic needs, improve nutrition, and enhance resilience.
Public works	Infrastructure Employment	Investing in public infrastructure (e.g., roads, water supply, sanitation). Creates jobs, boosts the local economy, and enhances community well-being.
Disaster risk insurance	Risk mitigation Financial protection	Insurance coverage against climate-related risks (e.g., crop failure, natural disasters). It helps households recover after shocks.
Diversified livelihoods	Skills training and entrepreneurship	Equipping individuals with vocational skills and supporting small businesses fosters economic diversification.
	Agricultural extension services	Providing knowledge on sustainable farming practices, crop diversification, and climate-smart agriculture improves rural livelihoods.

In summary, the National Tourism Strategic Labuan Bajo ASP program is a comprehensive strategy that empowers communities, reduces poverty, and builds resilience.

4.5. Implications of Adaptive Social Protection Approach for Poverty Reduction

The findings of this study highlight the critical need to balance economic growth with social equity, particularly in regions such as West Manggarai, where the benefits of tourism development have not reached all communities. The adaptive social protection (ASP) framework proposed in this study offers a comprehensive solution to poverty by integrating social welfare measures with disaster risk reduction and economic diversification. This approach is essential to ensure that vulnerable communities are not left behind as Labuan Bajo continues to grow as a National Strategic Tourism Area.

One of the key social implications of this study is its emphasis on reducing inequality by strengthening social protection systems for the most disadvantaged groups. By identifying poverty clusters and infrastructure gaps through spatial analysis, this study allows for more targeted interventions that can alleviate hardship in marginalised communities. This will ensure that poverty reduction efforts are not only broad-based but also tailored to the specific needs of different districts, promoting social cohesion and reducing inequalities within the region.

From a practical point of view, this study provides a valuable tool for policy makers and development planners. The use of geographically weighted regression and cluster mapping provides actionable insights into how poverty correlates with infrastructure distribution and economic activity. This evidence-based approach allows for more efficient allocation of resources, ensuring that investments in education, health, and communications infrastructure are prioritised in areas of greatest need. It also helps identify regions where

additional social protection programmes, such as cash transfers and public works, can have the greatest impact.

The research also highlights the importance of promoting community participation and cooperation between national and local authorities. By involving local communities in poverty reduction programmes and promoting livelihood diversification, the ASP framework not only addresses immediate economic vulnerability but also builds long-term resilience. This participatory model increases the sustainability of poverty reduction efforts, empowers residents to take an active role in their own development, and reduces dependence on seasonal tourism income.

This study serves as a blueprint for sustainable and inclusive development in tourism-driven regions. By bridging the gap between economic growth and poverty reduction, the proposed ASP framework has the potential to transform Labuan Bajo into a more equitable and resilient community. The lessons learned from this research can also be applied to other regions facing similar challenges, contributing to Indonesia's broader goals of reducing poverty and promoting sustainable development on a national scale.

5. Conclusions

Cluster analysis of poverty in Labuan Bajo, Indonesia, reveals five distinct poverty classes, ranging from very low to very high. The districts of Lembor Selatan and Sano Nggoang are classified as very low poverty, while Mbeliling is in the low class. Macang Pacar is classified as medium poverty, Boleng as high poverty, and Komodo as very high poverty. These findings highlight the complex socio-economic landscape of tourism-driven regions, where economic growth does not consistently translate into equitable prosperity for local communities. Understanding these localised poverty patterns is essential for designing targeted interventions that address inequalities, improve livelihoods, and ensure that economic benefits reach all segments of society.

Adaptive social protection (ASP) strategies have emerged as a key response to persistent poverty in Labuan Bajo. These strategies include targeting methodologies, cash transfers, public works, disaster risk insurance, and livelihood diversification to address the multiple challenges faced by communities. By using data-driven targeting, ASP ensures that aid is targeted to the most vulnerable, while public works and cash transfers provide immediate relief and long-term development opportunities. In addition, disaster risk insurance plays a critical role in protecting households from climate-related shocks, which are increasingly common in this disaster-prone region.

The strength of ASP lies in its ability to empower communities to prepare for, withstand, and adapt to economic and environmental adversity. By integrating social protection with adaptation and DRR, ASP promotes resilience and alleviates poverty, particularly for rural, agriculture-dependent populations. The targeting process takes into account poverty incidence and vulnerability to natural disasters, ensuring that interventions address localised risks. The combination of cash transfers, public works, risk insurance, and diversified livelihoods promotes sustainable economic growth while reducing dependence on tourism alone. This integrated approach positions the ASP as a long-term solution to poverty reduction in Labuan Bajo, building the resilience and stability of the region's economy and society.

Despite the promising results of the ASP framework, several limitations must be acknowledged. First, the availability and accuracy of geospatial and socio-economic data pose challenges to the precision of cluster analysis and geographically weighted regression. In some areas, data gaps or inconsistencies may lead to less reliable poverty classifications. In addition, the study's focus on infrastructure and economic indicators may overlook social and cultural factors that influence poverty dynamics. The ASP framework also

relies heavily on government capacity and community engagement, which can vary across regions and affect the scalability of interventions.

Future research should explore the intersection between ASP and the broader sustainable development goals (SDGs), particularly in relation to gender equality, education, and health. Further research is needed to assess the long-term impact of ASP programmes on poverty reduction and resilience building in Labuan Bajo and other regions. Comparative studies between different tourism-driven regions in Indonesia can provide insights into the replicability of ASP frameworks in different contexts. In addition, future studies should incorporate qualitative approaches, such as community interviews and participatory assessments, to capture the lived experiences of marginalised populations and refine the ASP framework to address their specific needs. In conclusion, the ASP framework is an important step towards reducing poverty and promoting inclusive growth in Labuan Bajo. By addressing the limitations and expanding the scope of the research, policymakers and stakeholders can build more adaptive, equitable, and resilient communities and ensure that tourism-driven economic growth benefits all residents, not just a select few.

Author Contributions: Conceptualization, A.G. and R.E.; Methodology, A.G. and D.P.; Validation, A.G.; Formal analysis, A.G.; Data curation, R.E.; Writing—original draft, A.G. and D.P.; Writing—review & editing, A.G.; Supervision, R.E., A.F. and B.B. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Informed Consent Statement: Not applicable.

Data Availability Statement: The original contributions presented in this study are included in the article. Further inquiries can be directed to the corresponding author.

Conflicts of Interest: The authors declare no conflict of interest.

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