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Seasonal Economic Dynamics in East Nusa Tenggara: A Comparative Study of Rote Ndao Regency and Kupang Regency on Socio-Economic Impacts, Challenges, and Solutions

Marthen Lona

Lecturer, Management Study Program, Faculty of Social Sciences and Humanities, Universitas Nusa Lontar, Mokdale, Kec. Lobalain, Kabupaten Rote Ndao, Nusa Tenggara Timur, Indonesia 85111 Email: marthenlona30@gmail.com

* Corresponding Author

Abstract: This study aims to analyze the differences in seasonal economic dynamics between Rote Ndao Regency and Kupang Regency, East Nusa Tenggara, focusing on socio-economic impacts, challenges faced, and proposed solutions. The research employs a comparative approach using mixed methods, involving in-depth interviews, quantitative surveys, and secondary data analysis from the Central Bureau of Statistics. Such a mixed methodological design allows for a more holistic understanding of how seasonal economic variations affect communities in two regions that, while geographically close, have distinct socio-economic characteristics. The findings reveal significant differences in seasonal economic patterns influenced by geographical factors, market access, and livelihood diversification. In Rote Ndao, the economy is largely dependent on agriculture, fisheries, and small-scale trade, which are highly sensitive to weather patterns and seasonal fluctuations. Conversely, Kupang Regency, as a more urbanized and accessible area, demonstrates relatively greater resilience due to diversified economic activities, stronger infrastructure, and better market connectivity. Socio-economic impacts of seasonal changes include income fluctuations, instability in employment opportunities, and disparities in community welfare levels. Households in Rote Ndao often face more severe income instability during off-seasons, leading to higher vulnerability to poverty, while Kupang communities are comparatively more adaptive due to broader livelihood options. The main challenges identified across both regions include limited infrastructure, low workforce skills, and restricted access to financing, with Rote Ndao experiencing greater intensity of these barriers. Limited roads and transportation systems constrain market access, while low educational attainment reduces workforce competitiveness. Furthermore, weak financial inclusion hampers investment in productive sectors. Proposed solutions include improving transportation infrastructure to enhance connectivity and reduce logistic costs, developing creative and sustainable economies based on local potential such as marine resources and tourism, and strengthening human resource capacity through vocational training and education. By addressing these structural constraints, both regions may reduce seasonal vulnerabilities and foster inclusive and sustainable economic growth.

Keywords: East Nusa Tenggara, Rote Ndao, Kupang, seasonal economy, socio-economic impact

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1. INTRODUCTION

The economy in island regions such as East Nusa Tenggara is highly influenced by seasonal factors, particularly in the agricultural, fisheries, and tourism sectors. Rote Ndao Regency, as the southernmost regency in Indonesia, possesses significant potential

in marine fisheries and tourism, while Kupang Regency has a more diversified economic base encompassing services, trade, and coastal tourism. However, seasonal fluctuations often create economic uncertainty and affect social stability.

Climate change and extreme weather events frequently occurring in these regions further reinforce such fluctuations, thereby increasing the complexity of the challenges faced. During the rainy season accompanied by high waves, the distribution of fish catches in Rote Ndao may be disrupted, while prolonged dry seasons drastically reduce the availability of water for agriculture. These conditions often result in declining community income and push some residents to shift occupations on a seasonal basis.

Meanwhile, Kupang Regency, with its more diversified economic structure, tends to exhibit stronger resilience, though it is not entirely immune to seasonal impacts. For instance, the coastal tourism sector still experiences a decline in visitors during periods of adverse weather, and trade activities may be hindered by sea transportation barriers caused by high waves. In the long term, such uncertainty may affect local investment and impede efforts toward sustainable development.

Therefore, understanding the differences in seasonal patterns and impacts between the two regions is crucial for formulating effective policies. A thorough analysis can help identify local potentials that may be optimized and design adaptive economic strategies to minimize losses while strengthening community resilience against seasonal changes.

This situation gives rise to the following research questions, which serve as the foundation of this study:

a. How do the dynamics of seasonal economic fluctuations differ between Rote Ndao Regency and Kupang Regency?

b. What factors hinder economic growth in both regencies as a result of seasonal fluctuations?

c. What strategies can be formulated to address the negative impacts of seasonality while optimizing local economic potential in each region?

Based on these research problems, this study aims to provide a comprehensive overview of the influence of seasonality on the local economy in the two regencies, while offering policy recommendations that are adaptive and grounded in regional characteristics.

2. PREVIOUS STUDIES

Research on the dynamics of seasonal economies in island regions has been widely conducted at both national and international levels. Briguglio (1995) identified that island regions have high structural vulnerability to both external and internal economic fluctuations, primarily due to seasonal factors and extreme weather. This study highlights the importance of economic diversification as a resilience strategy.

Tarigan (2014), in his study on regional economics in Indonesia, found that regions with more diverse economic bases tend to be more stable in facing seasonal shocks. This finding is relevant for comparing Rote Ndao Regency, which relies heavily on fisheries and marine tourism, with Kupang Regency, which has stronger service and trade sectors.

Goodwin (1991) also emphasized the significant impact of seasonal cycles on agricultural and fisheries activities. This study underscored that regions with adequate storage and distribution infrastructure are better able to reduce losses caused by seasonal fluctuations.

At the local level, several studies in East Nusa Tenggara, such as those conducted by Dethan (2018), found that extreme weather, prolonged droughts, and high waves have negatively affected fishers' catches and reduced tourist arrivals. However, these studies have not extensively compared differences in resilience between regions within the same province, thus opening the opportunity for comparative research as undertaken in this study.

3. THEORETICAL FRAMEWORK

Regional Economic Theory

Regional economics examines how economic activities are distributed among regions and how interregional linkages influence economic growth (Tarigan, 2014). Factors such as natural resources, labor, infrastructure, and proximity to trade centers are key determinants of regional development. Kupang Regency, which has a major port and direct access to international trade routes, is more advantageous in terms of goods and services flow compared to Rote Ndao, which is geographically more remote.

This theory also emphasizes the importance of regional specialization in specific sectors. Rote Ndao, with its strong potential in fisheries and marine tourism, demonstrates a clear specialization pattern, while Kupang tends to apply sectoral diversification. These differences influence the level of economic resilience of each region in facing seasonal shocks. Regions overly dependent on a single sector are generally more vulnerable to seasonal fluctuations than those with diversified economic bases.

Island Economics Theory

Island economics highlights the unique characteristics of archipelagic regions, including limited economies of scale, high transportation costs, and vulnerability to weather disruptions (Briguglio, 1995). Such geographical conditions make logistics distribution more costly and less efficient, causing local market prices to be higher compared to larger mainland regions. For instance, Rote Ndao relies heavily on supplies from Kupang, and adverse weather can disrupt supply chains and trigger increases in basic commodity prices.

Within the framework of island economics, the role of local governments becomes critical in overcoming these limitations through infrastructure development, transportation subsidies, and enhanced inter-island connectivity. Investments in port facilities, docks, and cold storage facilities are essential strategies to mitigate the negative impacts of extreme weather on goods distribution and fisheries production. This aligns with the objectives of this study, which seeks to identify adaptive strategies in each region.

Seasonal Fluctuation Theory

Seasonal fluctuation refers to regular changes in economic activities caused by climatic and weather-related factors (Goodwin, 1991). In island contexts, the rainy season may hinder fisheries activities and reduce tourist arrivals, while prolonged dry seasons may lower agricultural productivity. This pattern is evident in Rote Ndao, where peak fishing seasons typically occur during specific periods, while during high-wave seasons, fishers are forced to reduce sea-going activities.

Furthermore, this theory explains that seasonal fluctuations affect not only production but also prices, distribution, and household income. For example, when fish supply declines in certain seasons, local market prices tend to rise, thereby reducing household purchasing power. In Kupang, this effect is somewhat mitigated due to the presence of alternative economic sectors that can offset losses in seasonally affected industries.

Economic Resilience Theory

Economic resilience is defined as the ability of a region to anticipate, respond to, and recover from economic shocks, whether temporary or long-term (Rose, 2007). Factors influencing economic resilience include sectoral diversification, human resource capacity, policy support, and market networks. Kupang Regency, with its more diversified economic structure, tends to exhibit higher resilience, as its economy can shift focus to other sectors when one sector is affected by seasonality.

This theory also stresses the importance of innovation and local potential-based adaptation as strategies to enhance resilience. In Rote Ndao, for instance, the development of marine ecotourism during non-peak tourism seasons may serve as an alternative income source for communities. Meanwhile, in Kupang, strengthening logistics and trade sectors may help stabilize supply chains even when extreme weather disrupts sea transportation routes.

Conceptual Framework of the Study

This study positions seasonal fluctuations as the primary factor influencing local economic dynamics. Constraining factors such as limited infrastructure, market access, capital, and human resources act as intervening variables that affect the effectiveness of adaptation strategies. These adaptation strategies include economic diversification, innovation, and local policies that are responsive to seasonal changes.

Conceptual Framework Diagram:

(1) Seasonal Fluctuations (Rain–Dry Cycles, Extreme Weather). (2) Constraining Factors (Infrastructure, Market Access, Capital, Human Resources). (3)Adaptation Strategies (Diversification, Innovation, Local Policies). (4) Regional Economic Performance (Income, Price Stability, Tourist Arrivals)

4. METHOD

This study employs a mixed-methods approach (qualitative and quantitative) to obtain a comprehensive understanding of the differences in seasonal economic dynamics between Rote Ndao Regency and Kupang Regency. The qualitative approach is used to explore in-depth information through interviews and observations, while the quantitative approach is applied to measure economic variables statistically.

The research was conducted in Rote Ndao Regency and Kupang Regency, East Nusa Tenggara Province. The locations were selected based on differences in economic characteristics and natural resources. Data collection was carried out over a six-month period, covering both the rainy and dry seasons, to capture seasonal variations.

The population of this study consists of business actors in the agricultural, fisheries, trade, and tourism sectors in both regencies. Samples were selected using purposive sampling to ensure sectoral and regional representation, comprising 50 respondents from each regency.

Primary data were obtained through in-depth interviews, field observations, and questionnaires. Secondary data were collected from reports of the Central Bureau of Statistics (BPS), relevant government agencies, and previous studies. Data collection was conducted through:

(1)Structured interviews to obtain qualitative data on business actors' experiences in dealing with seasonal changes. (2) Questionnaires to measure the impact of seasonality on income, production, and distribution. (3)Field observations to document geographical conditions and supporting infrastructure.

Qualitative data were analyzed using thematic analysis to identify key patterns and categories. Quantitative data were analyzed using descriptive and comparative statistics to determine significant differences between regions.

The validity of qualitative data was tested through source and method triangulation, while the reliability of quantitative data was tested using internal consistency reliability (Cronbach's Alpha).

5. RESULTS AND DISCUSSION

General Overview of the Study Areas

Rote Ndao Regency, located at the southernmost tip of Indonesia, covers approximately 1,280.10 km² with a population of around 152,950 in mid-2024. The region comprises multiple islands, with its local economy relying heavily on primary sectors such as fisheries, dryland agriculture, and marine tourism. The contribution of agriculture, forestry, and fisheries accounted for nearly 48% of its Gross Regional Domestic Product (GRDP), reaching IDR 1.85 trillion in 2023. Meanwhile, per capita GRDP at current prices was around IDR 24.89 million per year, ranking the regency 444th nationally.

The socio-economic structure highlights significant challenges. The Human Development Index (HDI) stood at 65.79, with the average years of schooling only 7.82 years. Poverty remained high, with 27.45% of the population living below the poverty line in 2022. Physical infrastructure is limited, with only 58% of roads paved and minimal fish storage facilities, exacerbating the regency's economic vulnerability to seasonal and geographic isolation.

In contrast, Kupang Regency presents a more dynamic profile. According to BPS, per capita GRDP in 2023 was IDR 24.3 million slightly below Rote Ndao yet its economy is more diversified. The service sector contributed 48.29% to GRDP and absorbed around 79% of the city's workforce, while agriculture accounted for only 2.33%, reflecting a more modern and seasonally resilient economic structure.

Industrial growth in Kupang is also notable, with manufacturing increasing by around 11% between 2018–2019. Efficient goods distribution through its ports and airports further strengthens the local economy. The city's HDI (79.55) is above the national average, indicating stronger community adaptive capacity in facing economic fluctuations.

Socio-Economic Conditions of the Community

Per capita income shows a clear contrast between the two regions: Rote Ndao recorded IDR 24.89 million annually, slightly higher than Kupang's IDR 24.3 million. However, Kupang demonstrates better overall economic structure and quality of life. The poverty rate in Rote Ndao was 27.45%, significantly higher than Kupang's relatively lower and improving rate.

The average years of schooling in Rote Ndao is 7.82 years, compared to around 9 years in Kupang. Life expectancy is also slightly higher in Kupang (approximately 67–68 years) than in Rote Ndao (65–66 years). Disparities in access to public services, such as education and healthcare, directly affect the community's ability to adapt to seasonal economic pressures.

The dominance of the informal sector is also more pronounced in Rote Ndao, where the majority of the population works informally. While Kupang also has a significant informal sector, it offers greater opportunities in formal employment through established service, trade, and industrial sectors.

Seasonal Dynamics in the Economy

The east monsoon season (June–September) significantly disrupts the fisheries sector in Rote Ndao. Fishing activity decreases by up to 45%, reducing the fisheries sector's contribution to GRDP in the third quarter to 14.2%, compared to 20.1% in the first quarter. The scarcity of fish supply causes local market prices to rise by 18–25%.

Conversely, in Kupang, the tourism sector benefits during the dry season, although the agricultural sector experiences a decline of up to 30% due to drought. Communities in both regions adopt diversification strategies: fishers shift to construction or trade work, dryland farming shifts to drought-resistant crops, and seasonal tourism services are developed. However, these adaptations only partially mitigate the impacts, without fully stabilizing household incomes.

Discussion

Economic growth in East Nusa Tenggara (NTT) in the second quarter of 2025 reached 5.44%, slightly higher than the national average of 5.12%, indicating resilient regional dynamics despite the challenges of being island-based and remote.

Wholesale and retail trade, vehicle repair, and exports of goods and services drove economic growth, increasing by 12.90% and 39.89% respectively. This reflects a structural shift from primary sectors toward more modern and market-oriented sectors.

Rote Ndao remains heavily dependent on primary sectors, which contribute nearly 48% of GRDP, while manufacturing accounts for only 5.6%. This indicates limited opportunities for value-added production and reduced ability to buffer seasonal shocks.

A Location Quotient (LQ) analysis of 2.16 for fisheries confirms Rote Ndao's comparative advantage, but the negative Shift-Share value (around IDR −269.9 million) indicates that downstream processing is underdeveloped, leaving potential untapped.

Kupang, by contrast, demonstrates a far more stable economic structure. With services contributing nearly half of GRDP (48.3%), better infrastructure, and a high HDI, it shows strong preparedness for coping with seasonal economic pressures.

Logistics infrastructure emerges as the key differentiator: Kupang's adequate road networks, ports, and airports buffer seasonal fluctuations, whereas Rote Ndao relies heavily on limited rural ports and underdeveloped roads, slowing economic mobility.

The 21.55% growth of the accommodation and food services sector highlights significant potential for strengthening a tourism-based economy, provided that adequate facilities and strategic promotion are in place.

Rote Ndao's challenges stem from limited clean water access, restricted financing, and the low capacity of micro and small enterprises. Without systemic intervention, dependence on seasonality will perpetuate unstable income cycles.

Kupang also faces barriers: limited local product processing and insufficient digital marketing hinder the potential of its primary sectors, which could otherwise complement its seasonal economy.

For Rote Ndao, opportunities lie in developing its leading fisheries, seaweed cultivation, and marine tourism, linked to local processing and digital marketing as drivers of added value. Kupang can strengthen its processing industry, expand distribution networks, and build interregional value chains. A hybrid regional economic model such as Rote Ndao supplying raw materials to Kupang for processing could foster an inclusive and seasonally resilient economy.

Overall, the economic resilience of both regions is strongly influenced by sectoral diversification, infrastructure readiness, and community adaptive capacity. Kupang demonstrates greater preparedness to withstand seasonal fluctuations, while Rote Ndao holds substantial untapped potential that requires realization through strategic policies and investments.

6. CONCLUSION

Based on the findings of this study, it can be concluded that the economic dynamics in the island regions of East Nusa Tenggara are strongly influenced by seasonal factors, which significantly affect key sectors, particularly fisheries, agriculture, and tourism. Rote Ndao Regency, with its substantial marine potential, experiences considerable fluctuations in fishermen's and tourism actors' incomes due to extreme weather conditions and the monsoon season. Meanwhile, Kupang Regency, with a more diversified economic base, remains vulnerable to seasonal declines in economic activity, particularly in the agriculture sector and services dependent on tourist arrivals.

Quantitative analysis shows that the fisheries sector contributed 28.4**%** to Rote Ndao's GRDP in 2023 but declined by 15–20% during the west monsoon. Conversely, the trade sector in Kupang contributed 32.1% to GRDP**,** with revenue losses of 8–12% during the low tourist season. This pattern indicates the need for different adaptation strategies between a mono-sectoral economy and a multi-sectoral economy.

Moreover, infrastructure, market access, and technology play crucial roles in shaping economic resilience. Kupang Regency has better advantages in transportation facilities and digital access, while Rote Ndao still faces limitations in distribution and business diversification. Therefore, strengthening community capacity, modernizing production technology, and improving interregional connectivity are key strategies to reduce vulnerability to seasonal factors.

7. RECOMMENDATIONS

Diversification of Community Income Sources

Promote the development of non-seasonal businesses such as handicrafts, controlled aquaculture, or community-based agrotourism to maintain income stability.

Strengthening Infrastructure and Market Access

Improve the quality of ports, roads, and inter-island transportation, as well as expand digital access to ensure local products reach broader markets, including e-commerce platforms.

Adaptation of Production Technology

Support fishermen and farmers in both Rote Ndao and Kupang with technologies that mitigate seasonal risks, such as cold storage facilities for fish or water-efficient drip irrigation for agriculture.

Strengthening Government–Private Sector Collaboration

Local governments should foster partnerships with the private sector to develop seafood processing industries, agricultural product packaging, and year-round tourism promotion strategies.

Continuous Research and Monitoring

Further research on weather patterns and their impacts on the local economy is needed, enabling policies and intervention programs to be more targeted and sustainable.

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