World Journal of Advanced Research and Reviews
eISSN: 2581-9615 CODEN (USA): WJARAI
Cross Ref DOI: 10.30574/wjarr
Journal homepage: https://wjarr.com/

(RESEARCH ARTICLE)

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Comparative analysis of the agricultural sector in Kupang City Using the Location Quotient (LQ) and Dynamic Location Quotient (DLQ) Approaches

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World Journal of Advanced Research and Reviews, 2025, 28(02), 1846-1854

Publication history: Received on 11 October 2025; revised on 20 November 2025; accepted on 22 November 2025

Article DOI: https://doi.org/10.30574/wjarr.2025.28.2.3899

Abstract

This study aims to analyze the position and dynamics of the agricultural sector in Kupang City compared to the Province of East Nusa Tenggara (NTT) using the Location Quotient (LQ) and Dynamic Location Quotient (DLQ) approaches. The data used are secondary data from the Central Statistics Agency (BPS), consisting of the Gross Regional Domestic Product (GRDP) by business field at constant 2010 prices for the period 2014–2019. The results show that, in general, the economic structure of Kupang City is dominated by tertiary sectors such as information and communication (DLQ = 4.92), transportation and warehousing (DLQ = 2.35), as well as accommodation and food service activities (DLQ = 1.99). Conversely, the agricultural sector has an LQ of 0.07 and a DLQ of 0.85, indicating that it is a non-base and non-prospective sector. This condition confirms the occurrence of structural economic transformation from the primary sector toward service-oriented sectors. Although its contribution is relatively small, the agricultural sector still plays an important role in supporting food security and providing informal employment. Policy recommendations are directed toward strengthening technology-based urban agriculture, improving dry-land management, and enhancing interregional policy synergy to achieve sustainable agricultural development in urban areas of NTT.

Keywords: GRDP; Location Quotient; Dynamic Location Quotient; Agriculture; Kupang City; East Nusa Tenggara

1. Introduction

The Regional economic development is an important part of national development, aimed at improving community welfare through the optimization of local potential [1]. Each region has unique economic characteristics based on its resource structure, industries, and level of social progress [2,4]. Therefore, identifying leading sectors becomes an essential first step in determining effective economic development policies [1,4].

Kupang City, as the capital of East Nusa Tenggara (NTT) Province, plays a strategic role as a center of government, trade, services, and transportation in eastern Indonesia [5]. However, the economic growth of Kupang City shows a different pattern compared to NTT as a whole [6]. While NTT still relies on the agriculture, forestry, and fisheries sector, Kupang City has experienced a shift toward the tertiary sector, particularly trade, communication, transportation, and government administration [5,6].

This phenomenon reflects a structural economic transformation, in which economic activities shift from the primary sector toward service-oriented sectors [9,11,12]. This condition raises an important question: to what extent does the agricultural sector still have a strategic role in the economic structure of Kupang City, and is this sector still prospective for development within the context of sustainable development.

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To answer these questions, this study uses the Location Quotient (LQ) and Dynamic Location Quotient (DLQ) methods [3,10]. These approaches provide insights into the comparative advantages and growth dynamics of the agricultural sector compared with its reference region, the Province of NTT.

2. Material and methods

This study uses secondary data obtained from official publications of the Central Statistics Agency (BPS) of Kupang City and BPS of NTT Province [5,6], in the form of Gross Regional Domestic Product (GRDP) data at constant 2010 prices by business field for the period 2014–2019 [7,8].

2.1. Location Quotient (LQ) Analysis

The LQ formula is used to determine the level of specialization of an economic sector in a region compared to a reference area [3,10]:

$$LQ_i = \frac{(GDRP_{i,Kupang}/GDRP_{Total,Kupang})}{(GDRP_{i,NTT}/GDRP_{Total,NTT})}$$

2.1.1. Interpretation criteria

- LQ > 1: base sector (regional leading sector)
- LQ = 1: balanced sector
- LQ < 1: non-base sector (non-leading sector)

2.2. Dynamic Location Quotient (DLQ) Analysis

DLQ is used to assess the growth prospects of a sector based on changes in the relative GRDP values over time [7,8].

$$DLQ_i = (\frac{1 + G_{i,Kupang}}{1 + G_{Total,Kupang}}) \div (\frac{1 + G_{i,NTT}}{1 + G_{Total,NTT}})$$

Interpretation

- DLQ > 1: prospective sector (growing faster than the province)
- DLQ < 1: non-prospective sector

The DLQ values were calculated for the 2014–2019 period and compared between Kupang City and NTT Province for each economic sector.

3. Results and discussion

3.1. Economic Structure of Kupang City

The analysis results show that Kupang City has an economic structure that has significantly shifted toward the tertiary sector. The information and communication sector has the highest DLQ value (4.92), followed by the transportation and warehousing sector (2.35), and the accommodation and food service sector (1.99). This indicates that the city's economy is increasingly oriented toward services and digitalization [7,8].

Conversely, the agriculture, forestry, and fisheries sector show an LQ value of 0.07 and a DLQ value of 0.85, meaning that this sector is neither a base sector for the city nor growing as rapidly as the agricultural sector at the provincial level. These values confirm that the role of agriculture in the urban economy is becoming increasingly marginal.

Table 1 Results of LQ and DLQ Analysis for Kupang City

No	Economic Sector	LQ	DLQ	Description
1	Agriculture, Forestry, and Fisheries	0,0703	0,8490	Non-base, Non-prospective
2	Mining and Quarrying	0,0726	1,7779	Non-base, Prospective
3	Manufacturing Industry	1,1218	0,4887	Base, Non-prospective
4	Electricity and Gas Supply	1,7456	0,2006	Base, Non-prospective
5	Water Supply, Waste, and Waste Management	2,3888	0,9265	Base, Non-prospective
6	Construction	1,3669	0,5081	Base, Non-prospective
7	Wholesale and Retail Trade	1,2558	0,6599	Base, Non-prospective
8	Transportation and Warehousing	1,3008	2,3509	Base, Prospective
9	Accommodation and Food Services	2,2655	1,9915	Base, Prospective
10	Information and Communication	1,9240	4,9194	Base, Prospective
11	Real Estate	1,1739	1,8275	Base, Prospective
12	Public Administration	1,0150	1,015	Base, Prospective

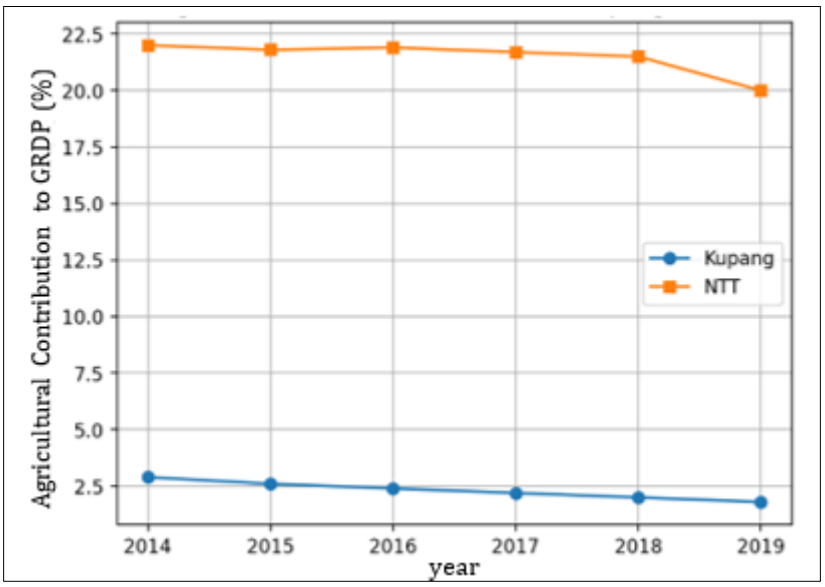

Figure 1 Contribution of the Agricultural Sector in Kupang and NTT

Based on Figure 1, it can be seen that the contribution of the agricultural sector to the GRDP of Kupang City continued to decline during the 2014–2019 period. In 2014, its contribution was still around 2.9%, but it decreased to only about 1.8% in 2019. Conversely, at the provincial level in NTT, the contribution of the agricultural sector remained relatively stable at around 20–22% over the same period.

This stark difference illustrates a significant shift in economic structure between urban and rural areas. As the center of economic and administrative activities, Kupang City has undergone a transformation toward the dominance of service, trade, transportation, and communication sectors. This phenomenon is known as the process of deagrarianization, in which the contribution of agriculture declines due to urbanization and the conversion of agricultural land into residential and industrial areas.

This condition is consistent with the findings of Hazell [11] and Briones [12], which emphasize that the agricultural sector in urban areas tends to shrink in its contribution to GRDP as industrialization and the growth of service sectors increase.

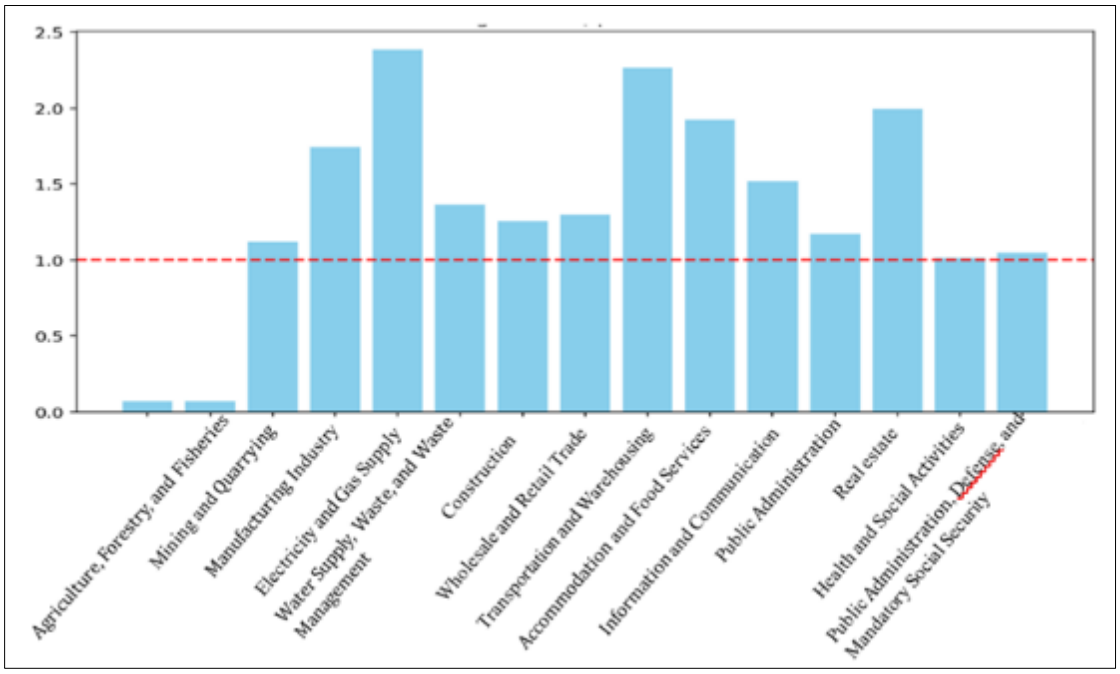

Figure 2 LQ by Sector

Figure 2 presents the LQ values for fifteen economic sectors in Kupang City. The LQ value indicates the level of specialization or relative advantage of a sector compared with the reference region (NTT Province). Sectors with an LQ > 1 are categorized as base sectors, meaning they have a larger contribution than the average of other regions; conversely, sectors with an LQ < 1 are considered non-base sectors.

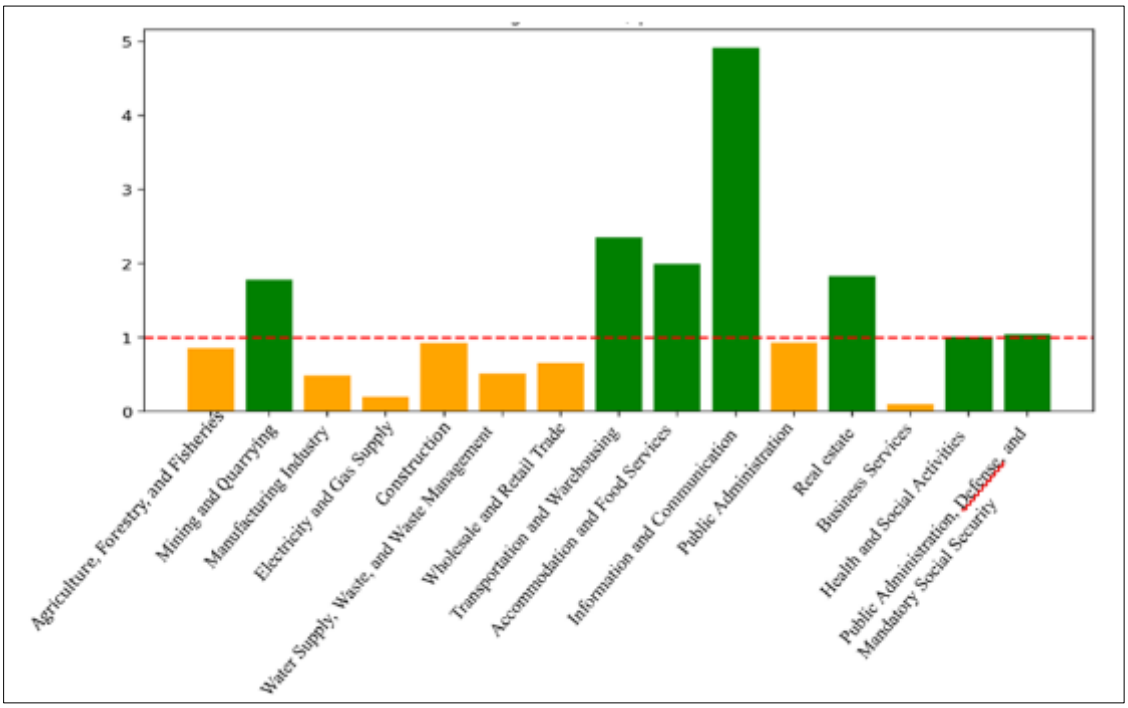

Figure 3 DLQ by Sector

The results show that the agriculture, forestry, and fisheries sector has a very low LQ (0.07), indicating that it is not a major pillar of the economy in Kupang City. On the other hand, service-related sectors such as accommodation and food services (LQ = 2.26), information and communication (LQ = 1.92), and transportation and warehousing (LQ = 1.30) have LQ values above one, signifying their important role in the city's economic structure. These findings reinforce regional economic base theory, which states that economic activities in urban areas tend to be dominated by service and trade sectors [11,6].

Figure 3 illustrates the Dynamic Location Quotient (DLQ) values, which measure the growth dynamics of each sector compared with the reference region over a certain period. A DLQ > 1 indicates a sector that is growing faster and is considered prospective, while a DLQ < 1 indicates a sector growing more slowly.

Based on the chart, the information and communication sector (DLQ = 4.92) and the transportation and warehousing sector (DLQ = 2.35) show the highest growth and can be categorized as future prospective sectors. Meanwhile, the agricultural sector (DLQ = 0.85) exhibits negative growth dynamics, indicating a decline in productivity relative to the city's overall economy.

These results demonstrate that economic transformation in Kupang City is shifting from the primary sector toward the tertiary sector. According to studies by EAI Proceedings [13], such patterns are common in medium-sized cities in Indonesia, where economic growth is increasingly driven by service and communication sectors rather than agriculture.

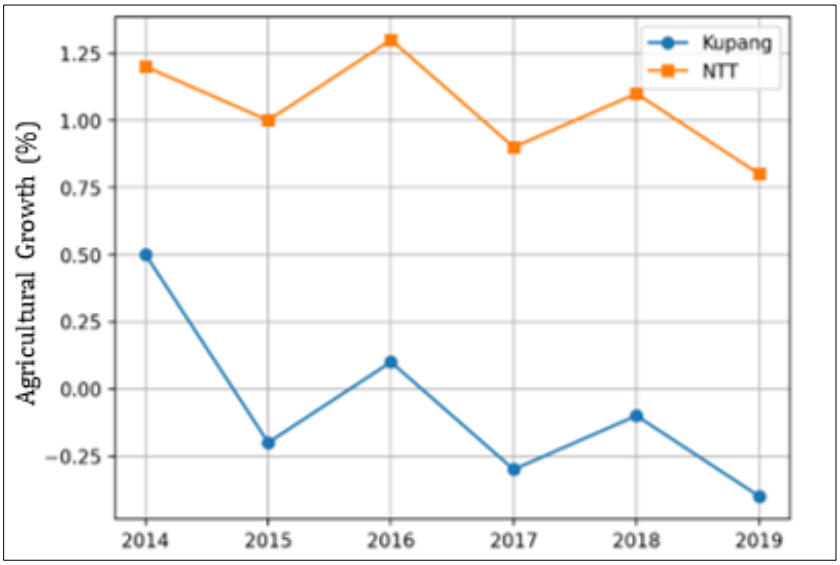

Figure 4 Agricultural Growth in Kupang and NTT

Figure 4 illustrates the annual growth rate of the agricultural sector in Kupang City and NTT Province. In general, the growth rate of the agricultural sector in Kupang is relatively stagnant and even shows negative fluctuations in several years, while at the provincial level there is still positive, although slowing, growth.

This condition aligns with the low DLQ value of the agricultural sector, which reflects its weak performance within the context of urban economic dynamics. The decline is caused by limited land availability, minimal investment in urban agricultural technology, and a shift of labor toward the trade and service sectors.

These findings are consistent with studies by FAO [14], which explain that rapid urbanization in Southeast Asian cities leads to a reduction in productive agricultural land and a transformation of the labor force toward non-agricultural sectors.

3.2. Sectoral Analysis Based on LQ and DLQ Values

3.2.1. Agriculture, Forestry, and Fisheries Sector

This sector has the lowest LQ value among all sectors, at only 0.07, indicating that its contribution in Kupang City is very small compared with the average in NTT Province. This means that the agricultural sector in Kupang accounts for only

about 7% of the concentration level of agriculture at the provincial scale. This condition arises because the city's economic structure has transformed toward service-oriented sectors, causing agriculture to lose its structural competitiveness.

The DLQ value of 0.85 indicates that the agricultural sector in Kupang is growing more slowly than agriculture at the provincial level in general. This phenomenon reflects a process of deagrarianization, in which labor, land, and investment shift from agricultural activities to non-agricultural sectors. Nevertheless, agriculture still plays an important role in providing local food supplies and informal employment, especially for low-income communities.

If this trend continues, Kupang City will become increasingly dependent on food supplies from other districts in NTT, and even from outside the province. This poses risks to local food security if transportation disruptions or increases in logistics costs occur.

To address this condition, strategies for revitalizing urban agriculture are needed, such as the development of urban farming, vertical farming, hydroponics, or integration with service sectors such as culinary tourism and environmental education.

3.3. Mining and Quarrying Sector

The low LQ value indicates that the mining and quarrying sector is not a base sector in Kupang City, as mining activities are more prevalent in inland areas of NTT such as South Central Timor or Flores. However, the DLQ value of 1.78 shows that this sector is prospective, meaning that although its current contribution is small, its growth is relatively fast compared with other regions in the province

This growth can be interpreted as an indication of the emergence of supporting activities and mining-related services in the city, such as the trade of construction materials, heavy equipment logistics, or mining company offices that operate outside the city but are headquartered in Kupang. This phenomenon is common in provincial capital regions: secondary economic activities related to mining tend to be concentrated in the city even though the physical extraction does not occur there.

However, a challenge for this sector is the minimal direct impact on the urban population, as economic gains are largely captured by large companies and not absorbed into the local economy. Therefore, the growth prospects of this sector should be directed toward strengthening local supply chains such as developing logistics services and heavy equipment maintenance that utilize local labor.

3.3.1. Manufacturing Industry Sector

The manufacturing sector has an LQ value above one (1.12), meaning it is still a base sector in Kupang City. Being a base sector indicates that it has a relatively high level of specialization compared with the province as a whole. However, the low DLQ value (0.49) shows that although this sector is important, its growth is stagnant or slowing compared with industrial growth at the provincial level.

The main factors contributing to this condition include limited local raw materials, industrial infrastructure that is not yet integrated, and high logistics costs. Many industries in Kupang focus on small-scale local consumption products, such as processed foods, rice milling, or household goods, which struggle to expand into inter-island export markets due to limited economies of scale.

Thus, although this sector is classified as a base sector, its contribution to GRDP and employment will not increase significantly without stronger support for small and medium industries.

Recommended policies include strengthening industries based on local resources, such as marine products processing, livestock products (meat, milk), and dried horticultural products (chili, shallots, beans). Such industries would create upstream–downstream linkages with the agriculture and fisheries sectors.

3.3.2. Transportation and Warehousing Sector

The transportation and warehousing sector is one of the sectors with a high LQ value (1.30) and a high DLQ value (2.35). This means the sector is both a base and a prospective sector: it is a structural strength of Kupang City and is growing faster than the provincial average. This is very logical given Kupang's position as a logistics center, a major seaport, and the main air gateway for the entire NTT region.

Growth in this sector is also driven by increasing inter-island trade activities, the mobility of goods and people, as well as the development of the tourism and trade sectors. The infrastructure of Tenau Port, El Tari Airport, and the land transportation network strengthens Kupang's function as a logistics hub.

From a development planning perspective, this sector can act as a growth engine that stimulates other sectors, including agriculture, through greater supply chain efficiency. Investment in cold storage and horticultural distribution systems can reduce losses in agricultural and fishery products. Thus, although this sector is not directly linked to agriculture, its synergy holds great potential for strengthening the city's food system.

3.3.3. Accommodation and Food Services Sector

The accommodation and food services sector shows a very strong advantage with an LQ of 2.27 and a DLQ of nearly two (1.99). This means the sector is twice as concentrated in Kupang compared with the provincial average and is growing almost twice as fast. This condition indicates that tourism and culinary services have become one of the new drivers of Kupang City's economy.

This growth is driven by the increasing flow of domestic and regional tourists, as well as the expansion of consumer service industries involving hotels, restaurants, and catering services. The sector also creates opportunities for direct integration with local agriculture. Stable demand for fresh food supplies from hotels and restaurants can become a potential market for local farmers if managed through an efficient supply chain and adequate quality standards.

A suitable policy direction is to develop link-and-match programs between peri-urban farmer groups and hotel/restaurant businesses through supply contracts for fresh local products (vegetables, fruits, eggs, fish). In this way, the rapidly growing service sector can function as a "demand engine" for revitalizing local agriculture.

3.3.4. Information and Communication Sector

This sector has the highest DLQ value among all sectors (4.92), indicating very rapid growth. The LQ value above 1 (1.92) also shows that this sector is a base sector in Kupang City's economy. The combination of LQ > 1 and DLQ > 1 indicates that the information and communication sector is a key leading sector with sustained growth.

This increase is driven by expanding internet penetration, the growth of telecommunications operators, and rising digital activities (online services, e-commerce, online education). In the context of regional economics, this sector boosts productivity across sectors by facilitating access to information, business coordination, and digital services.

Its linkage with the agricultural sector is also becoming evident, particularly in the development of digital agriculture (smart farming), marketing of agricultural products through online platforms, and weather and market information systems. Therefore, the development of the digital economy in Kupang not only enhances the efficiency of service sectors but also has the potential to become an enabler for the increasingly marginalized agricultural sector.

3.3.5. Real Estate Sector

The real estate sector also shows a strong position as a base sector (LQ 1.52) with positive growth prospects (DLQ 1.27). The rapid expansion of this sector is directly correlated with urbanization and intensive physical infrastructure development in Kupang. However, the growth of the property sector also creates consequences for the availability of agricultural land in peri-urban areas due to the conversion of farmland into housing and commercial facilities.

Spatial planning policies that control land-use conversion are therefore crucial to ensure that property sector growth does not compromise ecological balance and food security. In this sense, the real estate sector represents a paradox: on one hand, it supports economic growth, but on the other, it has the potential to worsen the pressures faced by the agricultural sector.

3.3.6. Government Administration and Education Services Sector

These two sectors do not exhibit extreme values like other service sectors, yet they remain important pillars of the city's economy due to Kupang's role as the provincial capital. Government administration and education create indirect demand for local consumer goods, including food supplies, transportation, and accommodation. As a result, their growth remains stable and their socioeconomic contribution continues to be significant.

The linkage with the agricultural sector can be optimized through the procurement of local food products for public facilities and educational institutions, thereby creating an institutional market for local agricultural products.

3.3.7. General Implications of LQ and DLQ Patterns

Across all sectors, it is evident that the tertiary sector dominates and shows prospective growth (DLQ > 1). The primary sector especially agriculture is in the most vulnerable position, with low contribution and slow growth. This pattern reflects the structural transformation of the city's economy from a production-based to a consumption- and service-based economy.

However, to maintain long-term economic balance and resilience, strategies are needed to strengthen cross-sector linkages so that agriculture remains connected to the urban economic system. The principle of "growth with inclusion" should be applied: the growing service sectors must provide space for the sustainability of the primary sector and local production base.

3.4. Agricultural Dynamics in Kupang and NTT

GRDP trends show that the contribution of the agricultural sector in Kupang City declined from 2.9% (2014) to 1.8% (2019). In contrast, at the provincial level in NTT, the contribution of agriculture remains dominant at over 25%. This indicates a regional economic duality: Kupang is developing as a center for services and government, while other areas in NTT remain predominantly agrarian.

The factors contributing to the weakness of Kupang's agricultural sector include:

- Conversion of agricultural land into residential and commercial areas.
- Limited water resources and irrigation on drylands.
- Low investment in technology and land productivity.
- Shift of labor orientation toward the service sector.

Nevertheless, this sector remains socially and ecologically important. Urban agriculture has the potential to serve as a buffer for local food supply, a source of informal employment, and a component of climate change mitigation strategies.

3.5. LQ and DLQ Analysis of the Agricultural Sector

he low LQ value (0.07) indicates very limited specialization, while the DLQ value (0.85) shows growth slower than the provincial level. This means that economically, the agricultural sector in Kupang City has lost its relative competitiveness. However, strategically, revitalizing agriculture remains necessary to maintain food security and balanced regional development.

Recommendation

Recommended policies include

- Development of technology-based urban agriculture (hydroponics, urban farming).
- Utilization of dryland areas through drip irrigation systems and rainwater management.
- Strengthening local agro-industrial value chains and digital marketing of agricultural products.

4. Conclusion

Based on the analysis, the agricultural sector in Kupang City has an LQ of 0.07 (non-base) and a DLQ of 0.85 (non-prospective). This indicates that agriculture is not a leading sector and grows more slowly than at the provincial level. Kupang's economic structure is dominated by the service and government sectors, reflecting a structural transformation of the regional economy.

Nevertheless, the agricultural sector still plays an important social and ecological role. Therefore, regional development policies should focus on strengthening urban agriculture, increasing dryland productivity, and integrating the agricultural economy with service and supporting industrial sectors in urban areas.

Compliance with ethical standards

Acknowledgments

The authors would like to thank the Central Bureau of Statistics (BPS) of Kupang City and BPS of East Nusa Tenggara Province for providing access to secondary data used in this study. No external funding was received for the completion of this research

Disclosure of conflict of interest

The authors declare that there are no conflicts of interest or competing interests related to the publication of this manuscript.

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