

# ANALYSIS OF AGRICULTURAL SECTOR POTENTIAL TOWARDS ECONOMIC GROWTH IN NORTH SULAWESI PROVINCE

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**Abstract.** As the backbone of North Sulawesi's economy, agriculture faces declining contributions to GRDP and employment. This study identifies the potential of agricultural subsectors to increase economic growth and provides recommendations for agricultural development planning. Quantitative methods with Location Quotient, Dynamic Location Quotient, Shift Share, and Klassen Typology analysis were applied to time series data of North Sulawesi GRDP and national GDP constant price 2010 for the period 2013-2022 for food crops, horticulture, plantations, livestock, and fisheries subsectors. The result is that the five subsectors are base subsectors, but food crops and fisheries repositioned to non-base in the future. In the shift-share analysis, food crops are classified in the Loser quadrant, while horticulture, plantations, and livestock are the Mixed Winner quadrant, and fisheries are the Mix Loser quadrant. Klassen Typology analysis shows that food crops and fisheries are developing subsectors, while horticulture, plantations, and livestock are mainstay subsectors. This research recommends that the Department of Agriculture and Livestock prioritize La Nina mitigation irrigation infrastructure and drainage systems in disaster-prone areas and subsidize NKV certification for export-oriented breeders. For the Department of Plantation, this research recommends accelerating replanting of old coconut trees by using genetically modified seeds with high productivity.

## 1 Introduction

Economic growth is a positive change that reflects the ability of a region to increase the production of goods and services, while generating higher national income [1]. Economic growth comes from changes in GRDP from one period to the next, which is one of the real forms of regional economic development. Regional economic development requires government and community cooperation in managing resources. The agricultural sector plays a vital role in this regard, as it can work with other sectors to increase economic growth. The development of the agricultural sector can be done by utilizing regional potential as a driver of productive economic activities. Indonesia, as an agrarian country, has more than 60% of its population dependent on agriculture for livelihoods. North Sulawesi Province, famous for its agricultural sector has 355,091 hectares of agricultural land, but 15.85% of the land has not been optimally utilized. This indicates a gap in the management and utilization of existing resources. Some of the primary commodities in North Sulawesi agriculture include rice with a productivity of 4.2 tons per hectare, cabbage reaching 96,100 tons, coconut reaching 264,400 tons, pig farming which produces 27,400 tons of meat, and tuna reaching 56,700 tons. The production of these commodities supports the significant contribution of the agricultural sector to GRDP and employment. From 2013 to 2022, the agricultural sector contribution to GDP and labor absorption are fluctuated. Table 1.1 shows that the agricultural sector contribution to North Sulawesi's GRDP has decreased from 21,51% in 2020 to 20,90% in 2022.

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Table 1.1 Contribution of Agriculture Sector to GRDP and Labor Absorption in North Sulawesi Province [2]

Year	Contribution	
	GRDP (%)	Labor Absorption (%)
2013	22,05	34,50
2014	21,46	32,72
2015	20,73	31,93
2016	21,71	35,82
2017	21,52	25,42
2018	20,95	24,64
2019	20,83	28,52
2020	21,51	29,75
2021	21,08	25,08
2022	20,90	24,29
<b>Average</b>	<b>21,25</b>	<b>29,27</b>

The contribution to labor absorption was decreased from 29,75% in 2020 to 24,29% in 2022. Agriculture not only absorbs labor directly, but also opens up indirect employment opportunities in industry and processing. Labor absorption can indicate the level of regional economic growth, and sectors with significant labor absorption have the potential to become leading sectors [3]. However, the decline in the contribution indicates need to more effective agricultural economic development. This decline is caused by various factors, such as difficulties in managing agricultural land, changes in cropping patterns, or fluctuations in agricultural commodity prices that have a negative impact on agricultural commodity production. These two contributions indicate the importance of agricultural development, which can be started by maximizing the potential of each agricultural subsector.

Previous research used the LQ and DLQ analysis method from 2012-2017. The article explains the condition of the agricultural subsector in the province of North Sulawesi. The results show that the agricultural sector contributes significantly and is a base sector in North Sulawesi, so this potential needs to be maintained and developed in the future [4]. Other research using shift share analysis from 2017 to 2021, to identify the performance of the agricultural economy in North Sulawesi. The analysis results show that national economic growth had a negative impact on increasing the GRDP North Sulawesi and had a competitive advantage during that period [5].

Based on the decline in the agricultural sector contribution to GRDP and employment in North Sulawesi, an analysis is needed to identify the potential of the agricultural subsector in supporting economic growth. The objectives of this study were, 1) to determine the current and future agricultural subsector base of North Sulawesi Province, 2) to identify changes in the economic structure between North Sulawesi agricultural subsectors to the National economy, and 3) to determine the contribution of the agricultural subsector to the GDP of North Sulawesi Province.

## 2 Research Method

This research uses a descriptive quantitative method and was carried out for 2 months, from 15 January until 15 March 2025. Also uses secondary data, there are GRDP at constant price 2010 by business field and growth rate of GRDP in 2013-2022 at North Sulawesi province, also GDP at constant price 2010 by business field and growth rate of GDP in 2013-2022 at

the Indonesian level. In this research, the agricultural sector is used with five subsectors, such as food crops, horticulture, plantations, livestock, and fisheries. Using these five subsectors prioritizes the ability to contribute to the GRDP of North Sulawesi Province. This study uses four analysis techniques, with Location Quotient, Dynamic Location Quotient, Shift Share, and Typology Klassen. In this research, the agricultural sector is used with five subsectors, such as food crops, horticulture, plantations, livestock, and fisheries. Using these five subsectors prioritizes the ability to contribute to the GRDP of North Sulawesi Province.

## 2.1 Location Quotient

LQ analysis is used to analyze the concentration and distribution of regional resources [6]. This analysis uses the formula:

$$LQ_{i,t} = \frac{v_{ij,t}/V_{j,t}}{v_{i,t}/V_t}$$

Dimana:

$v_{ij,t}$  = GRDP of agricultural subsector in Province (North Sulawesi)

$V_{j,t}$  = Total GRDP

$v_{i,t}$  = GDP of agricultural subsector in national (Indonesia)

$V_t$  = Total GDP in National (Indonesia)

$j$  = North Sulawesi Province

$i$  = Agricultural Subsector (ADHK 2010)

$t$  = Year

The provisions in this method are as follow, if the  $LQ > 1$  then the agricultural subsector is categorized as a base sector, but if the  $LQ < 1$  the agricultural subsector is categorized as a non-base sector.

## 2.2 Dynamic Location Quotient

DLQ analysis is similar to LQ, but emphasizes the growth rate, where each sectoral value added and GRDP has its own average annual growth rate over a spesific period. The DLQ formula can be formulated as follows [7]:

$$LQ = \left[ \frac{(1 + q_{ij})}{(1 + Q_j)} \frac{(1 + Q_i)}{(1 + Q)} \right]^s$$

Description:

$q_{ij}$  = Average GRDP growth rate of agriculture subsector in Province

$q_i$  = Average GDP growth rate of agriculture subsector in National

$Q_j$  = Total average Provincial GRDP growth rate

$Q$  = Total average National GDP growth rate

$s$  = Difference between final and initial year (10 years)

After calculations, each agricultural subsector is classified into two categories: If the DLQ value  $> 1$ , then subsector is a base or leading sector in the future. If the DLQ value  $< 1$ , then subsector is non-base or nonleading sector in the future.

## 2.3 Shift Share Analysis

Shift Share analysis is used to identify changes and the role of the economy at the provincial level, and compare it with the same sector at the national level. Shift Share analysis consists of three components, national growth (National Growth Effect), proportional shift, and

competitive advantage (competitive shift/differential shift). The calculation uses the following formula [8]:

$$Dij = Nij + Mij + Cij \quad (1)$$

Description:

$Dij$  = Shift Share

$Nij$  = National Growth Effect

$Mij$  = Proportional Shift

$Cij$  = Differential Shift

### 2.3.1 National Growth Effect

National growth is an indicator that describes how much economic growth in a province affects the national economy. Here is the calculation formula:

$$Nij = E_{ij,t_0} \times \left( \frac{E_{t_1}}{E_{t_0}} - 1 \right) \quad (2)$$

Description:

$Nij$  : National Growth

$E_{ij,t_0}$  : Provincial Subsector GRDP initial years

$E_{t_1}$  : National GDP final year

$E_{t_0}$  : National GDP initial year

After calculating  $Nij$ , each agricultural subsector is classified into two categories: If  $Nij$  (+), then the economic growth of the province's agricultural sector/subsector is positively affected by national economic growth. If  $Nij$  (-), then the economic growth of the province's agricultural sector/subsector is negatively affected by national economic growth.

### 2.3.2 Proportional Shift

Proportional shift is an indicator that shows the relative change in performance due to certain factors in a subsector at the Provincial level against the same subsector at the National level. Here is the formula:

$$Mij = E_{ij,t_0} \times \left( \frac{E_{i,t_1}}{E_{i,t_0}} - \frac{E_{t_1}}{E_{t_0}} \right) \quad (3)$$

Description

$Mij$  : Proportional Shift

$E_{ij,t_0}$  : Provincial Subsector GRDP initial year

$E_{i,t_1}$  : National Subsector GDP final year

$E_{i,t_0}$  : National Subsector GDP initial year

$E_{t_1}$  : National GDP final year

$E_{t_0}$  : National GDP initial year

After calculating  $Mij$ , each agricultural subsector is classified into two, namely: If  $Mij$  (+), then the agricultural sector/subsector has faster growth than the same sector at the national level. If  $Mij$  (-), then the agricultural sector/subsector has slower growth than the same sector at the national level.

### 2.3.3 Differential Shift

Competitive advantage or Regional Share Shift Component is an indicator that provides an overview or information on the extent of industrial competitiveness in a compared to the economy at a higher level. The calculation is done using the following formula:

$$Cij = E_{ij,t_0} \times \left( \frac{E_{ij,t_1}}{E_{ij,t_0}} - \frac{E_{i,t_1}}{E_{i,t_0}} \right) \quad (4)$$

Description :

Cij : Proportional Shift

$E_{i,t_0}$  : National Subsector GDP final year

$E_{ij,t_0}$  : Provincial Subsector GRDP initial year

$E_{i,t_1}$  : National Subsector GDP initial year

$E_{ij,t_1}$  : Provincial Subsector GRDP final year

After calculating Cij, each agricultural subsector is classified into two, namely: If Cij (+), then the agricultural subsector at the provincial level has high competitiveness compared to the agricultural sector in other provinces at the national level. If Cij (-), then the agricultural subsector at the provincial level has low competitiveness compared to the agricultural sector in other provinces at the national level. Shift share analysis can be divided into four quadrants based on the value of proportional shift and competitive advantage [9], where:

Table 2.1 Classification of proportional and differential shift

Indicator	Proportional Shift (-)	Proportional Shift (+)
Differential Shift (+)	Mixed Winner	Winner
Differential Shift (-)	Losser	Mixed Losser

## 2.4 Typology Klassen

Klassen Typology analysis was used to identify the position and structure of economic growth in the agricultural sector in North Sulawesi Province by considering the agricultural sector at the national level as a reference. In Table 2.2, sectors are divided into four based on growth and contribution. The following is the calculation of Klassen typology [10]:

$$r_{ik} = \frac{P_{ikt} - P_{iko}}{P_{iko}} \times 100\% \quad r_i = \frac{P_{it} - P_{io}}{P_{io}} \times 100\% \quad (5)$$

$$y_{ik} = \frac{P_{ik}}{P_{tk}} \times 100\% \quad y_i = \frac{P_i}{P_t} \times 100\% \quad (6)$$

Description:

$r_{ik}$  : Provincial growth rate of sector i

$P_{it}$  : GDP of sector i at National in year t

$r_i$  : National growth rate of sector i

$P_{io}$  : GDP of sector i at National initial year

$y_{ik}$  : Provincial contribution of sector i to GRDP

$P_{ik}$  : Total GRDP of sector i at Provincial

$y_i$  : National contribution of sector i to GDP

$P_{tk}$  : Total GRDP sector at Provincial

$P_{ikt}$  : GRDP of sector i at Province in year t

$P_i$  : Total GDP of sector i at National

$P_{iko}$  : GRDP of sector i at Province initial year

$P_t$  : Total GDP sector at National

Table 2.2 Classification of Economic Sectors based on Klassen Typology

Indicator	Sectoral Contribution Below Average	Sectoral Contribution Above Average
Economic Growth Above Average	Potential	Leading
Economic Growth Below Average	Lagging	Developing

## 3 Results and discussion

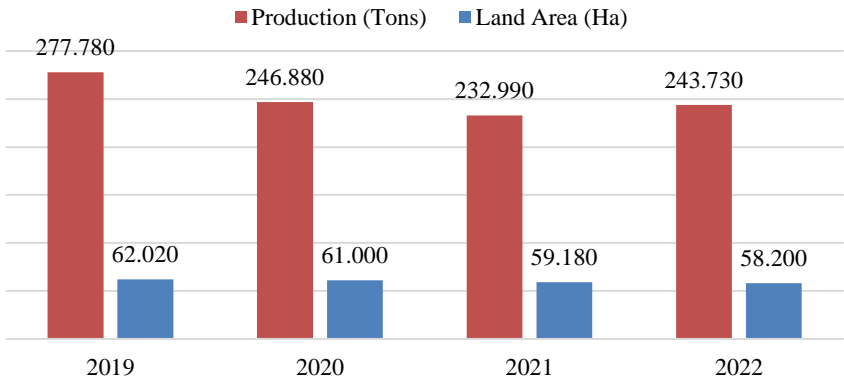
### 3.1 LQ and DLQ

The Location Quotient method is used to determine the leading subsectors by comparing of Provincial-level GRDP with National-level GDP. In contrast to LQ, the Dynamic Location Quotient method aims to determine economic subsectors that are superior and competitive in the future, so that the potential of a subsector can be maximized [11]. The results of the baseline analysis are shown in Table 3.1 below:

Table 3.1 LQ and DLQ Analysis Results

Subsector	LQ	DLQ	Criteria
Food Crop	1,07	0,08	Base and will reposition to non-base
Horticulture	1,51	10,70	Base and not repositioned
Plantation	1,56	2,19	Base and not repositioned
Livestock	1,34	2,20	Base and not repositioned
Fisheries	2,78	0,03	Base and will reposition to non-base

### 3.1.1 Food Crop



The results show that the food crop subsector has the advantage of meeting the needs within and outside the region, but in the future, it is projected to be able to meet only within its region. One of the obstacles in the economic growth of the food crop subsector is the decline in the area of rice fields due to land conversion. Based on Figure 3.1, from 2019 to 2021 rice production has decreased in the same direction as the decrease in rice land area. The conversion of wet agricultural land caused by socioeconomic factors such as age, land size, education level, and farming experience [12]. These factors generally characterize smallholders, namely ownership of land areas below 0,5 hectares. Smallholders mainly convert their land for agricultural and non-agricultural activities, such as switching commodities to horticulture or plantations that are much more profitable, or even selling land to the government or private sector as land for infrastructure and settlement development.

### 3.1.2 Horticulture

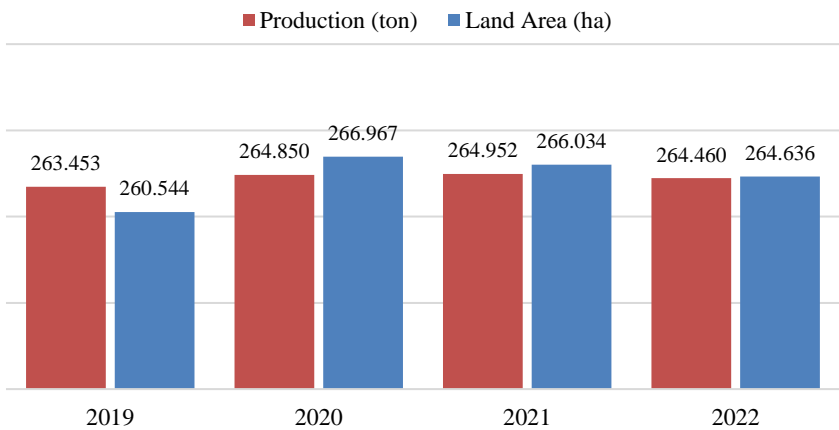
Horticulture subsector in North Sulawesi shows a vital role in the regional economy, with an LQ of more than one, which means that this region has an advantage and is a base sector in the North Sulawesi economy. On the other hand, the high DLQ value indicates that the horticulture subsector has excellent growth potential and is expected to play an increasingly important role in the regional economy in the future. These results align with research regarding the horticulture subsector, which showed stability from 2012-2017, and has the potential to continue to play a role in the economy in the future [4]. Based on Table 3.2, leading horticultural commodities show total production that fluctuates with an increasing

trend over the years. Various factors that support the growth of production are the suitability of location and climate with plants, ease of obtaining fertilizers, clear markets and prices that tend to be stable.

Table 3.2 Production of leading horticultural commodities in North Sulawesi [13]

Commodities	Year				
	2018	2019	2020	2021	2022
Cabbage (ton)	75.667	61.318	49.723	75.085	107.276
Banana (ton)	42.300	46.353	45.650	100.298	81.126
Ginger (ton)	1.390	623	468	1.547	2.036
Chrysanthemum (stalk)	4.750.606	5.485.678	4.200.344	4.375.238	6.035.129

3.1.3 Plantation



Plantation is one of the subsectors that has significantly contributed to the agricultural economy of North Sulawesi. The plantation subsector was able to meet demand within and outside the region, and is projected to remain base. In figure, coconut production and plantation area show a stable alignment. This ability is supported by land conditions and the availability of irrigation, which are important for plantation commodities. One of the primary plantation commodities in North Sulawesi is coconut. Almost 70% of individual farm businesses in North Sulawesi cultivate coconut crops, reaching 116.840 units [14].

3.1.4 Livestock

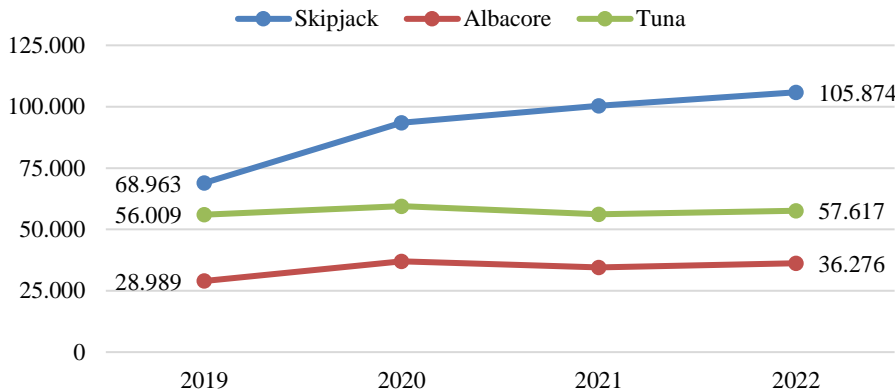
Livestock subsector showed a base condition from 2013 to 2022 and is projected to remain base. One of the supports for the livestock subsector to become a base is the pig farming business developed by the local community. Pork is a local need for the community, because it follows the cultural and religious preferences of consumers who are mostly Christian. Based on Table 3.3, pigs population in North Sulawesi Province reached 397.942 tails in 2022, production reached 26,8 million kg with 35% coming from Minahasa Regency. This data is reinforced by research that the livestock subsector is classified as basic in Minahasa Regency, with an LQ value of 2,33 [15].

Table 3.3 Pig population and production in North Sulawesi

Indicator	Year			
	2019	2020	2021	2022

<b>Population (tail)</b>	427.777	419.839	387.495	397.942
<b>Production (million kg)</b>	25,61	26,74	27,19	26,88

### 3.1.5 Fisheries



The fisheries subsector become a base subsector based on the results of the base analysis in North Sulawesi. However, this subsector will be repositioned to non-base in the future due to illegal, unreported, and unregulated fishing (IUU Fishing). The cause comes from fishermen who do not report their catches to the base port, but sell them directly to the Philippines in the middle of the sea [16]. Other research explained that Tuna fish are vulnerable to IUU fishing practices, especially unreported catches due to their high selling value [17]. Figure 3.3 shows that the trend of Tuna fish production is stagnant.

### 3.2 Shift Share Analysis

Shift share analysis is used to determine the components that influence the economic growth of a region. The analysis was carried out on the economic structure of the North Sulawesi region, which has a larger reference economy, namely at the national level. The following are the results of the shift share analysis in Table 3.4:

Table 3.4 Shift Share Analysis Results [18]

Subsector	Proportional Shift	Differential Shift	Shift Share	Classification
Food Crop	-1.024,48	-91,44	182,80	<i>Loser</i>
Horticulture	-185,86	315,73	881,07	<i>Mix Winner</i>
Plantation	-770,59	597,23	1.965,81	<i>Mix Winner</i>
Livestock	-159,21	238,83	759,51	<i>Mix Winner</i>
Fisheries	59,35	-867,58	1.605,00	<i>Mix Loser</i>

Based on the classification in Table 3.4, food crops are included in the loser classification, meaning that the subsector experiences economic decline in the North Sulawesi region and the National as a reference. In the proportional shift, this subsector has a negative value of IDR 1.024,48 billion, which indicates slower growth than the national and can potentially become a lagging subsector [19]. The competitive advantage component of food crops decreased by IDR 91,44 billion, so it has a low competitive advantage compared to other regions. Thus, the change in GRDP obtained only reached IDR 182,80 billion.

The results of the shift share show that the horticulture, plantation and livestock subsectors are classified as mixed winners, which means there is a decline in performance compared to



the national level, but still has a competitive advantage. In the horticulture subsector, the classification is reflected in a negative proportional shift value of IDR 185.86 billion and a positive competitive advantage value of IDR 315.73 billion. With these results, the horticulture positively contributed on North Sulawesi economic growth of IDR 881.07 billion.

The plantation subsector is a subsector with slow growth compared to the national level, this result is supported by a negative proportional shift value of IDR 770,59 billion. In the competitive advantage component, the plantation subsector has a positive value of IDR 597,23 billion, so it has a high competitive advantage compared to other regions on a national scale. The economic growth component of the plantation subsector produced a positive change of IDR 1.965,81 billion in the North Sulawesi GRDP.

The livestock subsector had a negative proportional shift of IDR 159,21 billion and a positive competitive advantage of IDR 238,83 billion. These two components show that the livestock subsector experienced a slowdown in economic growth compared to the national level, but still had a high competitive advantage over other regions. The growth experienced by the livestock subsector resulted in a positive change of IDR 759,51 billion in the North Sulawesi economy. Pig livestock is an important livestock commodity, with many supporting industries that process pig livestock products.

The fisheries subsector is classified as a mixed loser, which means that the fisheries subsector experienced faster growth than the national level, but with a low competitive advantage compared to other regions. This result is shown through a positive proportional shift component of IDR 59,35 billion and a negative competitive advantage component of IDR 867,58 billion. These two components produced a positive economic change of IDR 1.605 billion in North Sulawesi's GRDP and contributed positively to the fisheries national level.

### 3.3 Klassen Typology

The pattern and structure of economic growth in a subsector can be identified based on two main indicators in the form of GRDP and its growth. Furthermore, the observed subsectors can be mapped into four classifications, namely mainstay, potential, developing, and lagging subsectors. There are the results of the Klassen Typology analysis in Table 3.5:

Table 3.5 Klassen Typology Results								
Subsector	rik		ri		yik	yi	Classification	
Food Crop	7,74	<	11,62		3,08	>	2,89	Developing
Horticulture	64,53	>	41,41		2,16	>	1,42	Mainstay
Plantation	50,56	>	35,20		5,92	>	3,79	Mainstay
Livestock	61,46	>	42,14		2,05	>	1,52	Mainstay
Fisheries	36,59	<	56,37		6,32	>	2,30	Developing

Based on Table 3.5, the food crop subsector is classified as a developing subsector. The reason is that the growth rate of food crops in North Sulawesi is slower than the national level. This slowing economic growth is also in line with the decline in the welfare of food crop farmers in North Sulawesi, based on research the farmer exchange rate (NTP) for rice and secondary crops from 2021 to 2022 has a declining value [20]. The declining NTP means there is an imbalance between the low commodity prices received by farmers and the value spent by farmers. The low level of farmer welfare reflects the unsuccessful economic development of the food crop subsector, because welfare is a benchmark with indicators through food crop NTP [21]. The North Sulawesi Agriculture and Livestock Service Office, through its 2021 to 2026 strategic plan, sets a target of increasing rice and corn production

by 2% per year, with commodity intensification programs in the form of using certified superior seeds, agricultural mechanization equipment assistance, and strengthening agricultural extension workers.

The horticulture, plantation, and livestock subsectors are included in the mainstay subsectors (Table 3.5). The horticulture subsector, with leading commodities such as cabbage, bananas, ginger and chrysanthemums, is the main player capable of recording advanced and rapid economic growth. These four leading horticultural commodities have their production centers in North Sulawesi. The concentration of agricultural commodity production is regulated in the North Sulawesi Agriculture Strategic Plan 2021 to 2026. Agriculture in the central area is related to economic growth, because income. This is align with the research in Mindanao, Philippines, which states that concentrated agriculture can increase revenue, maintain price stability and production quality [22].

Plantations are among the mainstay subsectors that can record a fast increasing economic growth rate. This is supported by the region's ability to combine policies, production, and competitiveness of plantation commodities, thus creating positive economic growth. The policy is contained in North Sulawesi Governor Regulation No. 06 of 2022 concerning the North Sulawesi Regional Government Work Plan for 2023 states that the downstream coconut industry is in the development plan in several districts/cities [23]. The results of the implementation of this policy being able to record export volumes reaching 204.373 tons with a valuation of USD 228,7 million [24].

North Sulawesi's livestock subsector is classified as a mainstay subsector. This ability is reflected in the contribution and growth rate that is greater than the national level. North Sulawesi shows the ability to absorb pig livestock products. In 2022, North Sulawesi contributed 17.49% to the national recorded slaughter and became the second largest pig slaughter in Indonesia after Bali Province. However, there were still 26.051 unrecorded slaughter in North Sulawesi in 2022 [25].

The analysis shows that the fisheries subsector is a developing subsector. The reason is that the growth rate of fisheries in North Sulawesi is slower than the national level. One of the causes is IUU fishing, which harms large pelagic capture fisheries in WPPNRI-715 (Maluku sea waters) reaching IDR 3.660 billion per year, and 89% of the perpetrators are Indonesian Fish Vessels [26].

## **4 Conclusion and recommendation**

The LQ and DLQ analysis results show that all five agricultural subsectors are base subsectors, but food crops and fisheries will be repositioned as non-base in the future. In the Shift Share analysis, food crops fall into the loser quadrant, while horticulture, plantations, and livestock fall into the mixed winner quadrant, and fisheries are in the mix loser quadrant. The Klassen Typology analysis shows that food crops and fisheries are developing subsectors, while horticulture, plantations, and livestock are key subsectors. This research confirms that horticulture, plantations, and livestock are potential subsectors in North Sulawesi need to be maximized. To achieve this, the North Sulawesi Agriculture and Livestock Office should prioritize irrigation and drainage infrastructure in disaster-prone areas to mitigate La Nina's impact on horticulture, and subsidize NKV certification for export-oriented livestock farmers and slaughterhouses. Simultaneously, the North Sulawesi Plantation Office should accelerate the equitable replanting of old coconut trees using high-productivity genetically seedlings to optimize the subsector's potential.

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