JURNAL AGROEKOTEKNOLOGI TERAPAN
Applied Agroecotechnology Journal
Agroteknologi Universitas Sam Ratulangi **e ISSN:2797-0647**

Strategy for the Development of Sustainable Horticultural Vegetable Based on Leading Commodities in Tomohon City

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Manuscript received: 23 Sept. 2024.
Revision accepted: 14 Oct. 2024.

Abstract

The purpose of the study was to determine the superior vegetable commodities in Tomohon City, analyze priority factors, and find strategies for sustainable superior vegetable development in Tomohon City. Data collection from May to July 2024 and reporting in August to October 2024. The location of the study was in Tomohon City, at coordinates LU 10.191 - 10.281 and BT 10.18'.51"- 1240.49'.40" (BPS, Tomohon in Figures, 2022). Respondents were selected through purposive sampling, comprising a total of 15 individuals, including 3 decision-making officials: the Head of the Agriculture Service, the Head of the Food Service, and the Head of the Environmental Service. The research variables consist of internal and external factors. The analysis method comprises basic commodity analysis, Shift-Share Analysis (SSA) analysis, Delphi analysis, Analytical Network Process (ANP), SWOT analysis,, and Quantitative Strategic Priority Management (QSPM) analysis. The results of the study show that the priority factors in the development of Sustainable Vegetable Horticulture Agribusiness Areas in Tomohon City consist of land conditions, high prices, productivity, low capital, limited labor, limited production facilities, out-of-town marketing, local marketing, government programs, out-of-town products, product damage and pests and diseases. The priority superior commodities in the development of Sustainable Vegetable Horticulture Agribusiness Areas in Tomohon City consist of the first priority of carrots, the second priority of mustard greens, and the third priority of cabbage. Development Strategy with priority stages of increasing production, increasing marketing, increasing quality, government assistance, organic fertilizer, crop rotation, capital loans, and pest and disease control.

Keywords: Strategy, Area, Horticulture, Vegetables, Sustainable

INTRODUCTION

Vegetable development in Tomohon City consists of carrots, cabbage, mustard greens, cauliflower, spring onions, cayenne pepper, and tomatoes. Based on data from the Tomohon City Agriculture Service, it is known that from 2019 to 2021, the largest planting and production area was for carrots and cabbage commodities. The planting and production area of vegetables from 2018 to 2021 decreased, in 2018 reaching 350 and 625 ha with a productivity of 28,000 kg/ha and 22,000 kg/ha. In 2022, the area of carrots and cabbage reached 300 ha and 425 ha, respectively, with a production of 25,000 kg/ha and 20,000 kg/ha (Tomohon City Agriculture Service, 2023).

The Tomohon City Spatial Plan (RTRW) for 2013-2033 in terms of spatial structure of Tomohon City has designated several vegetable development areas. The Rurukan area in East Tomohon District is a Sub-City Service Center. The Rurukan area is included in the development of trade and service areas that support agro-industrial activities, as well as the development of horticultural areas for vegetable plants. In addition, it is also included in the strategic area from the perspective of environmental interests in the Tomohon City area (Pantouw &, RJ Poluan, 2018) .

Constraints of reduced planting area and production in 2020-2021 are possible due to the COVID-19 pandemic which has caused a decrease in people's purchasing power, reduced availability of labor, increased pesticide prices, and increased fertilizer prices. During the COVID-19 pandemic, there was an increase in the

selling price of vegetables, but the amount of production decreased drastically, causing farmers' incomes to decrease.

Agricultural development often causes environmental damage, Sustainable agriculture is a solution to keep the environment safe. Sustainable agriculture aims to achieve a balance between economic prosperity and ecological conditions. Sustainability can be achieved by not using resources faster than they can be reproduced, both in social and ecological terms. (Mebrate, 1998; Ostrom & Dietz, 2002; WCED, 1987 in Wang, 2017).

The problems of vegetable production development in Tomohon City lie in unstable vegetable prices, high labor costs, scarcity of fertilizers, lack of supporting facilities, environmental damage and use of chemicals. This study aims to determine the superior vegetable commodities in Tomohon City, analyze the strategies for developing superior vegetables in Tomohon City, and map sustainable superior vegetable development areas in Tomohon City. The benefits of this study are to identify superior vegetables, to identify the development strategies for these vegetables, and to produce a map that illustrates the mapping of superior vegetable planting locations.

The expected achievement of this research is an increase in the production of superior vegetables such as carrots, cabbage, mustard greens, spring onions, chilies and tomatoes. Based on this research, it is expected that every year there will be an average increase in production that can reach 10%. The level of farmer income can increase by an average of 5% per year. The achievement of reducing labor costs is by utilizing agricultural mechanization, where patterned planting can be done using agricultural tools. The reduction in labor costs averages 10% per year. The use of organic fertilizers can overcome the scarcity of store fertilizers or factory fertilizers. The reduction in the use of store fertilizers or chemical fertilizers reaches 10% per year.

MATERIAL AND METHOD

Time and Place

This research was conducted from March 2024 to October 2024, namely from the preparation activities and the preparation of research reports. This research was conducted in Tomohon City at a location with coordinates LU $1^0.19^{\ 1}$ - $1^0.28^{\ 1}$ and BT $1^0.18'.51^{\ "}$ - $124^{\ 0}.49^{\ '}.40^{\ "}$ (BPS, Tomohon in Figures, 2022).

Data Collection Methods

The data collection methods used in this study consist of primary data and secondary data.

Sampling Method

Primary data were obtained from interviews with 15 respondents. Interviews with 3 decision-making officials, namely the Head of the Agriculture Service, the Head of the Food Service, and the Head of the Environmental Service. Interviews with 2 experts, namely environmental experts and economists, and 10 farmers. Respondents were selected by *purposive sampling*.

Research Variables

1. Vegetable production from 2020-2023
2. Land area (ha)
3. Location of land
4. Production Amount (kg/ha)
5. Selling Price (Rp/kg)
6. Labor usage and costs (Rp/ha)
7. Use and costs of production facilities (Rp/ha)

Analysis Methods

Location Quotient (LQ) Analysis

The research data analysis method uses several data analysis methods, such as: the basic commodity analysis method, using the formula: (Annisa & Santoso, 2020)

$$LQ = \frac{\frac{Xij}{Xi}}{\frac{Xj}{X}}$$

***Shift Share Analysis* (SSA)**

This analysis is used to determine the shift in activity structure at a particular location compared to a reference at two points in time. Shift-share analysis uses three basic pieces of information that are related to each other, namely: Regional Share Growth (PPW), Proportional Growth (PP) and Net Growth (PB) (Annisa & Santoso, 2020) .

$$SA = \left(\frac{X..(t1)}{X..(t0)} - 1\right) + \left(\frac{X.j(t1)}{X.j(t0)} - \left(\frac{X..(t1)}{X..(t0)}\right)\right) + \left(\frac{Xij(t1)}{Xij(t0)} - \frac{X.j(t1)}{X.j(t0)}\right)$$

Where:

(a) = Regional share component (KPN)
(b) = Proportional Shift Component (KPP)
(c) = Differential Shift Component (KPPW)
X.. = Aggregate value of the total area activity
Xj = Value of the sum of certain activities in the aggregate region
Xij = Value of region i and activity j
t1 = End year point
t0 = Initial year point

Result description:

KPPW > 0 = sector i has good competitiveness
KPPW < 0 = sector i has poor competitiveness
KPP > 0 = sector i has rapid growth
KPP < 0 = sector i has slow growth
PB > 0 = growth of sector i is included in the progressive (advanced) group
PB < 0 = growth of sector i is slow
PB = PPW + PP

***Delphi* Analysis**

The steps of *the Delphi* method in this study are: (Annisa & Santoso, 2020) . The first stage, the questionnaire was distributed to prospective respondents in this case, decision makers, experts or experts in fields related to the development of the Tomohon City vegetable horticulture agribusiness area, and farmers who were directly involved in farming activities. The second stage, after the questionnaire was revised, was collected again. After being collected, improvements were made according to input or suggestions from the respondents.

***Analytical Network Process* (ANP)**

Through the ANP method, competitors or clusters can be predicted and presented along with the alleged interaction between competitors and their member elements, including the relative strength of the interaction in an effort to influence each other in decision making.

SWOT Analysis

SWOT analysis is an analysis to produce alternative strategies. SWOT analysis consists of internal factors and external factors. *Internal Factor Analysis Strategy* (IFAS) to examine internal strategies and *External Factor Analysis Strategy* (EFAS) to examine external strategies.

Quantitative Strategic Priority Management (QSPM) Analysis

QSPM analysis is a continuation of SWOT analysis. QSPM analysis prioritizes strategies resulting from SWOT analysis. The steps for solving with QSPM analysis start with SWOT analysis. QSPM analysis consists of Attractive Strategy (AS) analysis and *Total Attractive Strategy* (TAS). *Total Attractive Strategy analysis* is obtained from the weighted *Attractive Strategy*.

RESULTS AND DISCUSSION

Analysis of Determining Priority Superior Commodities

Determination of superior commodities is carried out through two stages, namely searching for basic vegetable crop commodities and searching

for commodities that have high competitiveness with good growth rates and are classified as progressive commodities. The Tomohon City Vegetable Horticulture Agribusiness Area is a combination of the North Tomohon Sub-District Area located at coordinates 10 ^{0} - 270 ^{0} N and 114 ^{0} - 124 ^{0} E with an area of 45.6 km ^{2} (BPS, North Tomohon in Figures 2024). The East Tomohon Sub-District Area at coordinates, is located at 1 °.19'-1 °.28' North Latitude and 1 °.19'28"-124 °.55'30" East Longitude with an area of 14.14 km ^{2} (BPS, East Tomohon in Figures 2024).

The results of the LQ calculation related to vegetable horticultural commodities in the Tomohon City Vegetable Horticultural Agribusiness Area use data on the amount of production of each commodity from 2018 to 2021. The results of the LQ analysis can be seen in the following Table 1.

Based on Table 1, the results of the LQ analysis of more than 1 are found in 3 commodities, which are basic, namely carrots with an average LQ of 1.41, cabbage with an average LQ of 1.15, and mustard greens with an average LQ of 1.07. Commodities with an LQ value of more than 1 mean that the three commodities are the basis or a source of growth, have comparative advantages, and the results can not only meet the needs in Tomohon City but can also be exported outside the region. *Shift Share Analysis* calculation to determine the competitiveness, growth rate, and progressiveness of several vegetable horticultural plant commodities. The results of *the Shift Share* (SSA) analysis in the vegetable horticultural agribusiness area in Tomohon City can be seen in Table 2.

Table 1. Results of the Location Quotient (LQ) analysis of the Tomohon City Vegetable Horticulture Agribusiness Area

No	Vegetables	2020	2021	2022	2023	Average	LQ
1	Cabbage	1.05	1.42	1.19	1.25	1.23	Base
2	Spring onion	1.03	1.05	1.00	0.88	0.99	Non-Basic
3	Mustard	1.02	1.45	1.37	1.30	1.28	Base
4	Carrot	1.05	1.50	1.44	1.40	1.35	Base
5	Eggplant	1.06	0.82	0.89	0.59	0.84	Non-Basic
6	Chayote	0.93	0.63	0.52	0.72	0.70	Non-Basic
7	Cauliflower	0.91	0.78	0.81	1.09	0.90	Non-Basic

Table 2. Results of *Shift Share Analysis* of Vegetable Commodities in the Vegetable Horticulture Agribusiness Area of Tomohon City

No	Vegetables	PE	PE	PE	Average	SSA
1	Cabbage	-0.17	-0.06	-0.17	-0.13	Non-Basic
2	Spring onion	-0.47	-0.15	0.07	-0.18	Non-Basic
3	Mustard	0.00	0.07	-0.04	0.01	Base
4	Carrot	0.39	-0.07	-0.19	0.04	Base
5	Eggplant	-0.37	-0.24	-0.37	-0.33	Non-Basic
6	Chayote	-0.34	-0.51	0.31	-0.18	Non-Basic
7	Cauliflower	-0.59	-0.21	0.90	0.03	Base

Based on the results of the *shift share* analysis calculation, it can be seen that there are horticultural vegetable agricultural commodities with positive average values, namely carrots with an average value of 0.04, mustard greens with a value of 0.01, cauliflower 0.03 and there are also negative average values such as cabbage with a value of -0.13, spring onions and chayote with a value of -0.18 and eggplant with a value of -0.33.

Based on the calculation of LQ and SSA analysis, the next analysis uses Klassen's typology. *Klassen's* typology is

used to obtain the classification of growth positions for each vegetable commodity. The following is the *Klassen Typology* in the Vegetable Horticulture Agribusiness area of Tomohon City (Figure 1).

According to Klassen's typology, it can be concluded that carrots, cabbage, and mustard greens are prospective superior commodities that will be included in the development strategy. The Tomohon City Vegetable Agribusiness Area consists of the North Tomohon Sub-District with coordinates 10 $^{0'}$ - 270 ^{0} N and 114 ^{0} - 124 ^{0} E and the East Tomohon Sub-District with coordinates 1 °.19'-1 °.28' North Latitude and 1 °.19'28"-124 °.55'30" East Longitude, the location of the area on the following Figure 2.

Quadrant II Progressive Commodities LQ < 1, PB > 1	Quadrant I Leading Commodities LQ > 1, PB > 1
Quadrant IV Non-superior commodities LQ < 1, PB < 1 Spring onion, eggplant, chayote, cauliflower	Quadrant III Prospective Commodities LQ > 1, PB < 1 Cabbage, Carrot, Mustard Greens

Figure 1. Typology of Vegetable Horticulture Agribusiness Area Classes, Tomohon City

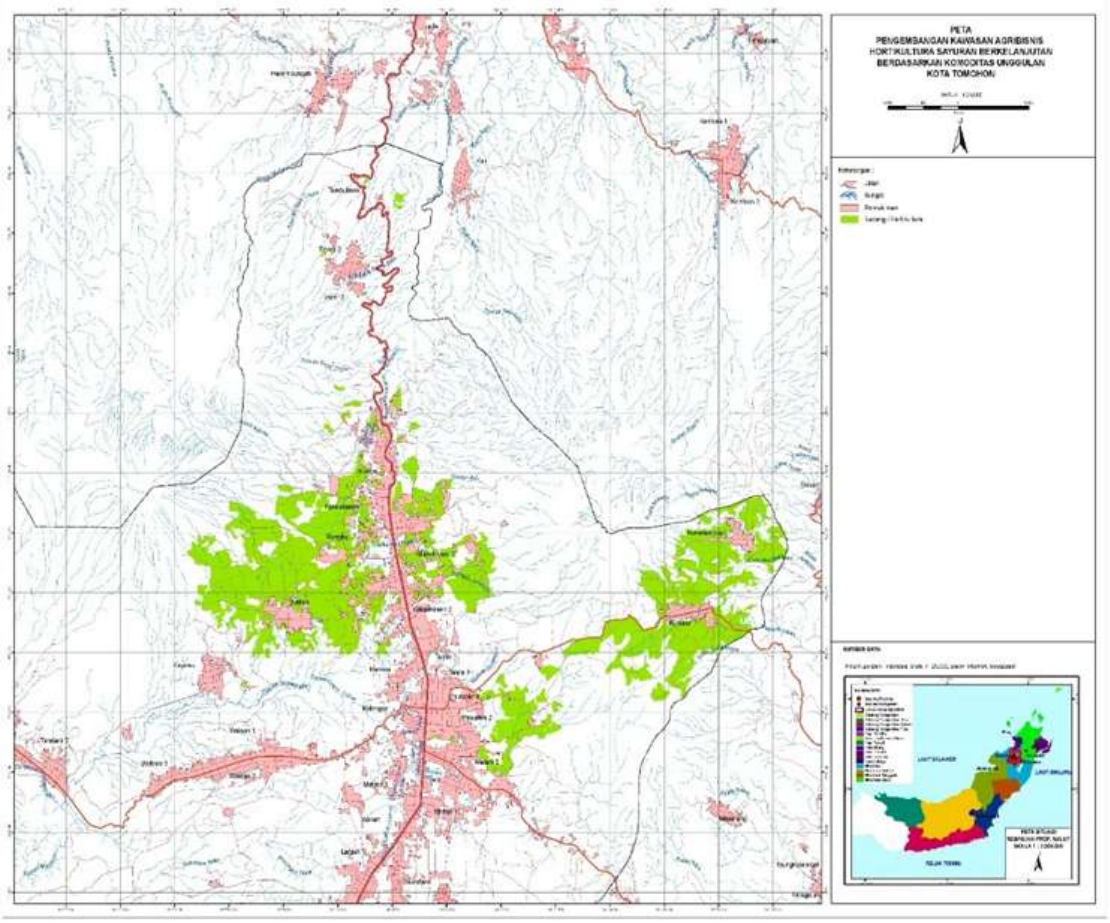

Figure 2. Map of the Vegetable Horticulture Agribusiness Area of Tomohon City

Analysis of factors influencing the development of priority superior vegetable horticulture agribusiness areas in Tomohon City.

The analysis conducted at this stage is a *Delphi analysis*. *Delphi analysis* is conducted in 2 stages. *Delphi analysis* is conducted by filling out questionnaires to 15 respondents, consisting of 3 respondents from the government, 2 respondents from experts, and 10 respondents from farmers. The results of the questionnaire based on *Delphi analysis* of the factors influencing the development of agribusiness areas based on superior vegetable commodities in Tomohon City can be seen in Table 3.

Table 3. Compilation of *Delphi Questionnaire Results*

No	Criteria	Department of Agriculture	Food Service	Department of Environment	Economist	Environmental Expert	Farmer
1	Land Conditions	7	7	6	7	5	8
2	High Price	7	6	5	7	5	8
3	Productivity	6	6	5	7	5	7
4	Low Capital	7	5	5	7	5	7
5	Limited Manpower	7	5	5	7	5	8
6	Limited Production Facilities	4	4	5	5	4	7
7	Out of Region Marketing	6	5	5	7	5	8
8	Local Marketing	6	5	4	7	5	7
9	Government Programs	8	8	7	7	5	5
10	Out of Region Products	5	5	5	7	5	6
11	Product Damage	5	6	5	6	5	6
12	Pests and Diseases	4	5	5	5	6	7

Based on the results of interviews through *the Delphi* I (first) and *Delphi* II (second) questionnaires that have reached *a consensus*, the factors and assessments that influence the development of the priority sustainable Vegetable Agribusiness Area in Tomohon City consist of land conditions, high prices, low capital, limited labor, limited production facilities, marketing outside the region, local marketing, government programs, products outside the region, product damage and pests and diseases.

Formulation of directions for agribusiness development by the priority superior commodities of vegetable horticultural crops

Based on the results of the previous analysis, the third analysis was carried out, namely determining the development of agribusiness according to the priority superior vegetable commodities in the Tomohon City Vegetable Horticulture Agribusiness Area. To determine the weight of the development priority, this analysis uses *the Analytical Network Process* (ANP) with *Super Decisios software*. In this analysis, respondents from related stakeholders were asked to fill out a questionnaire in the form of a scale. The selected respondents were from the government, academics, and also successful farmers who were considered to know and be involved in the development of the Tomohon City Vegetable Horticulture Agribusiness Area.

The results of alternative analysis using the *Analytical Network Process* (ANP) with *Super Decisios software* it is known that the priority of vegetable development is first carrot, then mustard greens, and finally cabbage. The value of the ANP analysis results can be seen in Table 4.

Based on Table 4, the value of the analysis results can be seen using *the Analytical Network Process* (ANP) with *Super Decisios software.* The highest obtained value in carrots is 0.39228, then followed by the value of mustard greens, which reached 0.34162, and the lowest value for cabbage was 0.2661.

The results of the analysis of the criteria in the development of the Vegetable Horticulture Agribusiness Area in Tomohon City consist of criteria 1 to 12. The priorities of these criteria can be seen in Table 5.

Table 4. Results of *Analytical Network Process* (ANP) calculations

No	Alternative	Mark	Priority Level
1	Carrot	0.39228	1
2	Mustard	0.34162	2
3	Cabbage	0.2661	3

Table 5. Results of *Analytical Network Process* (ANP) calculations

No	Criteria	Weight	Priority Level
1	Land Conditions	0.15908	2
2	High Price	0.19358	1
3	Productivity	0.04964	8
4	Low Capital	0.11239	3
5	Limited Manpower	0.09782	5
6	Limited Production Facilities	0.07672	6
7	Out of Region Marketing	0.07381	7
8	Local Marketing	0.10056	4
9	Government Programs	0.03245	11
10	Out of Region Products	0.04421	9
11	Product Damage	0.03156	12
12	Pests and Diseases	0.03268	10

Directions for the development of superior vegetable horticultural commodities based on the results of ANP analysis using *Super Decision's software*, obtained weights and rankings. The results of the analysis show priority criteria from 1 to 12, namely:

1. High Price Priority

The first development priority is high price with a weight value of 0.19358. The high price priority in question is the selling price of vegetables obtained by farmers at the time of sale. The high price priority is the main priority of farmers in determining the type of vegetable planting. If at the time of harvest the selling price is high, it will have an impact on income and then high profits.

Farmers in farming activities always cultivate crops with high selling prices. The selling price of carrots, cabbage, and mustard greens based on information from farmers is Rp. 8,000 / kg, cabbage Rp. 3,000 / kg and mustard greens Rp. 2,000 / kg. So that the profit in carrot farming reaches Rp. 133,315,000.0 / ha, cabbage farming reaches Rp. 53,350,000.00 / ha and the lowest mustard green farming reaches Rp. 36,643,000.00 / ha.

2. Land Condition Priority

Land conditions are the second priority with a weight of 0.15908. The Tomohon City Vegetable Horticulture Agribusiness Area is located in two locations, namely in the North Tomohon District and East Tomohon District. The land cultivated by farmers is on a slope from flat to steep (slope of 8% -60%). This is possible because the farmers' land is on the back of the mountain and at the foot of the mountain. The North Tomohon Sub-District is at the foot of Mount Lokon with an altitude of 1400 meters above sea level.

The East Tomohon Sub-District is in the valley between Mount Mahawu and Mount Masarang, with an altitude of 1,200 meters above sea level and 1,000 meters above sea level (BPS Tomohon City in Figures, 2024).

The type of soil in the Tomohon City Vegetable Horticulture Agribusiness Area is Andosol. Agricultural land is located in the highlands, dominated by Andisols soil, which is formed from volcanic material. This Andisols soil is black to very dark brown and thick, sandy clay to sand texture, contains a lot of volcanic glass, has fairly fast permeability, and good drainage (Derek et al., 2021)

Soil type is an important determinant of soil fertility because of its unique biological, chemical, and physical properties. However, the fertility of upland soils may be altered by agricultural practices. Bacterial populations were higher in Andosol soils amended with fertilizers than in chemical farming practices (Wickramatilake et al., 2010). Andosols experienced a decrease in carbon content due to short-term farming practices in Japan (Takata, 2010). According to Motoki et al (2014), the absorption of agricultural chemicals in Andosols was higher than in other soil types due to their high carbon content. More than 50% of the highland land in Japan is Andosol land with a tendency for bacterial biomass degradation, which is likely caused by the application of chemical fertilizers and agricultural chemicals.

3. Low Capital Priority

Low capital priority is the third priority with a weight of 0.11239. Farmers in farming experience constraints in providing capital. The profits obtained are not sufficient for the next period of farming activities. Farmers cultivate land with an average area of 0.2 ha so that carrot farmers earn a profit of Rp. 26,663,000.0/ha for 4.5 months of farming activities, cabbage farmers earn a profit of Rp. 10,670,000.0/ha for 3.5 months of farming activities, and mustard green farmers earn a profit of Rp. 7,328,600.0 ha. The cost of carrot farming is Rp. 9,337,000.00/ha, cabbage farming is Rp. 7,330,000.0/ha and mustard green farming is Rp. 4,671,400.0/ha. The difference between the income and the costs is prepared for the next planting and is a fund prepared for daily expenses while waiting for the harvest time.

The capital referred to in this study is all costs incurred in farming activities. The price of carrots, although quite high, has a farming cost per hectare of Rp. 46,685,000.0 or a cost per kilogram of Rp. 2074.89, while cabbage has a farming cost per hectare of Rp. 36,650,000.0 or a cost per kilogram of Rp. 1,221.67/kg and mustard greens farming per hectare of Rp. 23,357,000.0 and a cost per kilogram of Rp. 778.57/kg.

The capital obtained by farmers for carrot farming activities comes from individuals and also from wholesalers. Farmers who obtain capital from wholesalers usually sell their harvests to wholesalers who lend capital. The harvest obtained will be deducted from the loan, but in the process, there is an agreement or negotiation. if the harvest in one season is not good, then farmers can ask the wholesaler to only deduct from the loan. Loan repayment will be made at the next harvest.

4. Local Marketing Priorities

Local marketing is the fourth priority with a weight of 0.10056. Farmers in the Tomohon City Vegetable Horticulture Agribusiness Area sell their harvests to wholesalers who sell at Beriman Market and inter-island wholesalers. Sales activities at Beriman Market are carried out every day so that wholesalers can make purchases and harvest every day. Farmers only sell to inter-island wholesalers at certain times, as this is due to irregular purchases by wholesalers.

Local marketing includes marketing in North Sulawesi Province, such as in

Manado City, Airmadidi City, Bitung City, and Minahasa Regency. Marketing is carried out in traditional markets and supermarkets. In addition to sales in markets and supermarkets, vegetables are also sold around using motorbikes and pick-up trucks.

5. Limited Workforce Priority

Limited labor use is the fifth priority with a weight of 0.09782. The use of labor greatly affects the types of vegetables that farmers will plant. The labor referred to in this study is human labor consisting of family labor (TKDK) and non-family labor (TKLK). Farmers who have many family members as family labor (TKDK) will choose carrot vegetable farming, while those who only rely on wage labor (TKDK) will choose cabbage and mustard green farming.

Labor use is also influenced by the availability of capital, farmers with large capital will choose carrot farming because they have funds to pay for labor. Labor costs in carrots cover 96.39% of the total cost, while in cabbage and mustard greens only 81.85% and 80.28%. Labor use at the research location consists of carrots 300 Hok/ha, cabbage 200 Hok/ha and mustard greens 125 Hok/ha.

The North Tomohon Sub-District population [is] 27,961 people, with 927 farmers and 225.5 ha of vegetable land (BPS, North Tomohon in Figures 2024). The population of the East Tomohon Sub-District is 10,045 people, with 950 farmers and 318.34 ha of vegetable land (BPS, East Tomohon in Figures 2024). Looking at the data on land area and number of farmers, it can be seen that the average area of land cultivated by farmers in the East Sub-District and North Tomohon Sub-Districts is 0.34 ha and 0.24 ha. If the average use of labor for each vegetable is 250 Hok, then the need for farmer labor is 72 Hok. The average need per farmer of 72 Hok illustrates that farmers must work during the planting season. Farmers will have difficulty if they are going to do work that requires labor simultaneously, such as in seedbed work, planting, weeding, and harvesting.

6. Limited Production Facilities

Limited production facilities are the sixth priority with a weight of 0.07672. The use of pesticides to eradicate pests and diseases, in addition to farmers using herbicides to eradicate weeds. Based on information from farmers274, the most cabbage farming actors use pesticides reaching 2.5 liters/ha, followed by mustard greens as much as 2.0 liters/ha, and the lowest carrot farming is only 1.0 liters/ha. The cost of purchasing pesticides in cabbage is IDR 1,750,000/ha, the cost of pesticides in mustard greens is IDR 1,200,000/ha, and in carrots, only IDR 400,000/ha.

The use of factory fertilizers is related to the use in planting cabbage and mustard greens. Farmers who are not members of agricultural farmer groups try to avoid planting cabbage and mustard greens because these two vegetables require a lot of factory fertilizers. Farmers who are members of farmer groups are allowed to buy subsidized fertilizers. The price of subsidized fertilizers is cheaper than the price of non-subsidized fertilizers, but only farmers who are members of farmer groups can obtain subsidized fertilizers. Meanwhile, the amount of subsidized fertilizer sales is very limited. The highest use of factory fertilizers in cabbage plants reaches 600 kg/ha, followed by mustard greens at 450 kg/ha, and the lowest in carrots at 150 kg/ha. The cost of purchasing fertilizers in cabbage reaches IDR 4,500,000/ha, the cost of fertilizers in mustard greens is IDR 3,375,000/ha, and the cost of fertilizers in carrots is only IDR 1,125,000/ha.

In addition to using manufactured fertilizers, farmers also use purchased manure for IDR 800/kg. The use of manure per hectare in cabbage is 500 kg, in mustard

greens is 400 kg, and in carrots is 200 kg. Farmers obtain manure from farms located in the development area.

7. Out-of-Region Marketing

Marketing outside the region is the sixth priority with a weight of 0.07381. Marketing of vegetable commodities from the Tomohon City vegetable horticulture agribusiness is carried out at the Agribusiness Sub Terminal (STA) of the Beriman Tomohon Market and markets outside Tomohon City, even to inter-island marketing. Inter-island marketing such as to Sangihe, Talaud, Maluku, Papua and Kalimantan. Marketing outside the region uses Pelni Ships and private passenger ships.

8. Productivity

Productivity is the sixth priority with a weight of 0.04964. Farming activities are calculated from planting to harvest. The shortest time for mustard greens is only 3 months, followed by cabbage farming for 3.5 months, and the longest is carrot farming for around 4.5 months. The high productivity referred to in this study is the amount of production obtained in an area of 1 hectare. The highest vegetable productivity in 2023 was in cabbage and mustard green farming of 25,000-30,000 kg/ha, followed by carrots of 20,000-25,000 kg/ha (BPS Tomohon City 2024). When compared to productivity in the Netherlands for Cabbage, it reaches 30-35 tons (Statistics Netherlands, 2019), while mustard green productivity in Batu City in 2019 was 17.25 tons.

9. Out-of-Region Products

Products from outside the region are the ninth priority with a weight of 0.04421. The superior vegetables in Tomohon City are carrots, mustard greens, and cabbage, and there are several vegetables that have development prospects, such as spring onions and cauliflower. Vegetable producing areas in North Sulawesi, besides Tomohon City, are Modoinding District in South Minahasa Regency and Langowan and Tompaso Districts in Minahasa Regency. Vegetables planted in Minahasa Regency and South Minahasa such as cabbage, mustard greens, carrots, spring onions. Modoinding District in South Minahasa Regency even plants potatoes, where potatoes are not found in Tomohon City.

10. Pests and Diseases

Pests and diseases are the tenth priority with a weight of 0.03268. Pest and disease attacks in the Tomohon City Vegetable Horticulture Agribusiness Area can be said to be quite high. The highest pest and disease attacks are found in cabbage and mustard greens, then the lowest in carrots. Carrots are resistant to pest and disease attacks because carrots are tuber vegetables in the soil. Pest and disease attacks on cabbage can be seen on leaves that already have many holes. Farmers use chemical pesticides to eradicate pests and diseases.

Pesticide use not only impacts production costs and the labor required for application, but there are serious concerns about the impact of pesticides on the environment and human health. Profitability of vegetable production, labor requirements and pesticide use are important variables to be taken into account when designing new vegetable cropping systems. (Thi et al., 2013) Farmers evaluate their production practices and the food safety of their products very positively. This view contrasts with expert reports indicating that improving safety is one of the main challenges of small-scale vegetable farming in Chile (Pertuzéet al.,2019;

11. Government Programs

Government Program is the eleventh priority with a weight of 0.03245. Tomohon City is a city that relies on the Agricultural Sector, Tourism Sector, and Service Sector. The Agricultural Sector is the largest sector

in contributing to the GRDP of Tomohon City. Tomohon City Government Programs in the Agricultural Sector, such as the Development of the Rurukan Agropolitan Area, the manufacture of fertilizers at the Integrated Organic Waste Processing Center (PPSOT), and agricultural mechanization by procuring *hand tractors* and *tractors.*

12. Product Damage

Product damage is the twelfth priority with a weight of 0.03156. Vegetable plants are commodities that are easily damaged. The comparison of the durability between carrots, mustard greens, and cabbage shows that mustard greens and cabbage are leafy vegetables that are damaged more quickly than carrots. Mustard greens have the fastest level of damage, so they are not marketed outside the region or between islands.

SWOT Analysis of the Development of Priority Sustainable Vegetable Horticulture Agribusiness Areas in Tomohon City

SWOT Matrix: Internal Factors and External Factors

The SWOT matrix of internal and external factors is different from the matrix of internal strategy analysis factors (IFAS) and external strategy factors (EFAS). The SWOT matrix of internal factors is obtained from the reduction of strength factors (Strength) and weakness factors (Weakness), likewise, the SWOT matrix of external factors is obtained from the reduction of opportunity factors (Opportunity) with threat factors (Threats). The weight value comes from the results of the ANP analysis, but has been converted into a total of IFE and EFE of 1. The Rating value comes from the answers of each respondent. The SWOT matrix of internal factors can be seen in Table 6.

Based on Table 6, it is known that the SWOT matrix of internal factors is 1.27, which is obtained from subtracting the strength factor of 2.26 from the weakness factor of 1.0. A larger strength factor, or in this case, a positive sign, indicates that there are strengths from the development of Priority Vegetable Horticulture Agribusiness Areas in Tomohon City. To see the SWOT matrix of external factors it can be seen in Table 7.

Table 7 shows the SWOT matrix of external factors is the result of subtracting the opportunity factor of 1.43 from the threat factor of 0.48 a resulting in 0.95. The calculation results show a positive number, meaning that there are opportunities in the development of the Priority Vegetable Horticulture Agribusiness Area of Tomohon City.

Table 6. Internal Factor SWOT Matrix

No	Strength	Weight	Rating	Score
1	Land Conditions	0.23	4	0.92
2	High Price	0.28	4	1.12
3	Productivity	0.07	3	0.22
	Amount			2.26
No	Weakness			
1	Low Capital	0.16	3	0.49
2	Limited Manpower	0.14	2	0.28
3	Limited Production Facilities	0.11	2	0.22
	Amount			1.00
	Total IFE Weight	1		1.27

Table 7. External Factor SWOT Matrix

No	Opportunity	Weight	Rating	Score
1	Out of Region Marketing	0.23	3	0.70
2	Local Marketing	0.32	1	0.32
3	Government Programs	0.10	4	0.41
	Amount			1.43
No	Threat			
1	Out of Region Products	0.14	2	0.28
2	Product Damage	0.10	1	0.10
3	Pests and Diseases	0.10	1	0.10
	Amount			0.48
	Total EFE Weight	1		0.95

SWOT Diagram of Internal and External Factors

A SWOT diagram is a diagram that shows the location of the calculation results in the analysis of internal and external factors. The SWOT diagram has 4 quadrants, namely quadrant 1 with the *Expansion strategy*, quadrant 2 with the *Diversification strategy*, quadrant 3 *Defensive* and quadrant 4 with the *Stability strategy*.

The calculation results on internal factors, consisting of strength factors and weakness factors, with a value of 1.27. The calculation results of external factors, consisting of opportunity factors and threat factors, with a value of 0.95. The position of the horizontal line coordinates 1.27 and the vertical line coordinates 0.95 indicates that they are in quadrant I. The location of the point in the diagram is shown in Figure 3.

SWOT Strategy Matrix

The SWOT strategy matrix is obtained by connecting internal factors and external factors. Internal strength factors are connected to external opportunities and threats. Internal weaknesses are connected to external opportunities and threats.

Based on Table 8, it can be seen that there are 8 strategies for developing the Agribusiness Area.

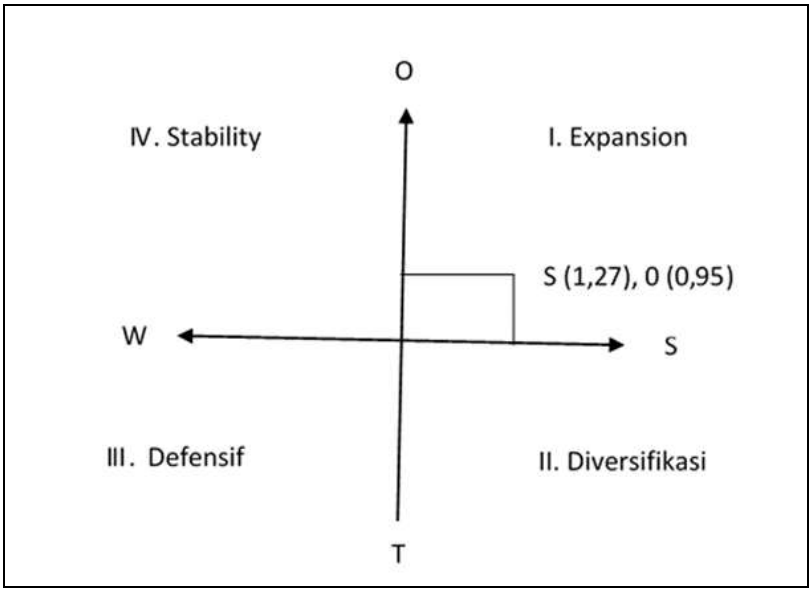

Figure 3. SWOT matrix of regional development

Table 8. Strategy Matrix for Developing Superior Vegetable Horticulture Agribusiness Areas in Tomohon City

No	Factors	Power Factor (S)	Weakness Factor (W)
		1. Land conditions	1. Low Capital
		2. High Price	2. Limited Manpower
		3. Productivity	3. Limited Saprotan
	Opportunity Factor (O)	(SO Strategy)	(WO Strategy)
1.	Overseas Marketing	1. S1, S2, S3, O 1, O 2	1. W1, W2, W3, O3
2.	Local Marketing	Increase production	Government Assistance
3.	Government Programs	2. S2, O1, O2	2. W1, O1, O2
		Improve Marketing	Capital Loan
	Threat Factor (T)	(ST Strategy)	(WT Strategy)
1.	Out of Region Products	1. S1, S3, T3	1. W1, W2, W3, T3
2.	Product Damage	HP Control	Plant rotation
3.	Pests and Diseases	2. S2, T1, T2	2. W1, W3, T2, T3
		Quality Improvement	Organic fertilizer

Sustainable superior vegetable horticulture in Tomohon City consists of:

SO Strategy

1. Increased Production

Increased production is carried out with the availability of suitable land, high productivity, and high prices, in addition to the opportunities for marketing outside the region and local marketing. The East Tomohon Sub-District prioritizes carrots, but farmers must rotate crops, considering that soil fertility will quickly decrease if only planted with carrots. The North Tomohon Sub-District prioritizes planting cabbage and mustard greens. Increased production can be done by intensification, namely the addition of production facilities and extensification, namely by utilizing land that was previously planted with less superior vegetables, in this case chayote and eggplant.

2. Marketing Enhancement

Marketing improvement can be done with high prices and opportunities for marketing outside the region and local marketing. Marketing prospects outside the region are more open with the presence of Nickel mining in Weda, Maluku, and Morowali, West Sulawesi.

ST Strategy

1. Pest and Disease Control

Pest and disease control is done by increasing the area of planting and pest and disease attacks. High pest and disease attacks are usually on cabbage and mustard greens. The highest level of attack will occur during the dry season.

2. Quality Improvement

The quality improvement was done because of the high price and the threat of similar vegetables from outside Tomohon City such as from Modoinding, South Minahasa Regency and Langowan, Minahasa Regency. Cabbage and mustard greens are widely planted in Langowan and carrots are widely planted in Modoinding.

WO Strategy

1. Government Assistance

The increase in government assistance is carried out due to low capital ownership in farmers, limited availability of labor and limited availability of agricultural inputs. The Tomohon City Government has a vegetable seed assistance program through the Regional Food Service and Agricultural Mechanization assistance with the provision of subsidized fertilizers and hand tractors, and tractors through the Agriculture and Fisheries Service. The assistance from the Tomohon City Government is considered not evenly distributed and shared among all farmers. So the Tomohon City Government is

required to further increase budgeting in the Tomohon City APBD.

2. Capital Loan

Capital loans are made because of the limited availability of capital to farmers. Capital loans can be made because there is an opportunity to increase income with prospects in marketing outside the region and local marketing. Low capital ownership is caused by low vegetable sales, which also impacts low income. Cabbage and mustard greens have low selling prices, and with an average planting area of only 0.2 ha, the income is low. Quite high income is found in carrots, but carrot planting is only allowed in the Tomohon Timur Sub-District. Carrot planting must have crop rotation. The carrot land planting pattern is 2 times carrots and once planted with other types of vegetables.

WT Strategy

1. Plant Rotation

Crop rotation is carried out with low capital, limited labor and limited production facilities, and pest and disease attacks. Farmers who lack capital when planting are advised to plant vegetables with low costs, such as cabbage and mustard greens. Crop rotation can suppress pest and disease attacks, so it will have an impact on pesticide purchases and labor use.

2. Organic fertilizer

The use of organic fertilizers is carried out due to the low availability of capital and the limited availability of production facilities, such as manufactured fertilizers, and the threat of product damage during post-harvest and pest and disease attacks. Organic fertilizers can be made by farmers from the remains of vegetable waste that has been harvested or from household waste. Farmers can make liquid organic fertilizers and solid organic fertilizers.

QSPM Matrix

The QSPM matrix aims to determine priority strategies that will be implemented in the development of the Sustainable Superior Vegetable Horticulture Agribusiness Area of Tomohon City. The QSPM matrix uses *attractive scores* (AS) and weight values determined by respondents. The *attractive score* and weight values will produce *a total attractive score* (TAS) (Table 9). Based on Table 9, the priority level of each alternative strategy can be seen using QSPM analysis. There are 8 alternative strategies where the priority level is based on the order of numbers 1 to 8.

Table 9. Results of TAS Score Calculation on QSPM Matrix

No	Alternative Strategy	Mark	Priority Level
1	Increased Production	6.93	1
2	Marketing Enhancement	6.32	2
3	Pest and Disease Control	5.18	8
4	Quality Improvement	5.98	3
5	Government Assistance	5.85	4
6	Capital Loan	5.43	7
7	Plant Rotation	5.75	6
8	Organic fertilizer	5.82	5

1. Increased Production

Increased production is done by looking at vegetable production data, which is still low. Production can still be done by considering the price of vegetables, which is still high. Increased production can be done by improving farming methods. The Tomohon Timur Sub-District has a sloping and very sloping topography, and only a small part with flat and sloping land, which causes difficulties in making beds. Farmers in the Tomohon Timur Sub-District make

beds with a terracing system. The Tomohon Utara Sub-District has a sloping and flat land topography, and only a small part is slightly sloping, which makes it easier to make beds.

2. Marketing Enhancement

Marketing improvement can be done by expanding the marketing area; in this case, the marketing target is outside the region. Improvement of packaging methods and transportation systems can help in marketing outside the region. Marketing outside the region can increase the number of vegetable sales and result in a higher selling price compared to the local market. Marketing vegetables outside the region at this time seems to be easier than before.

3. Quality Improvement

Quality improvement can be done by arranging the planting distance and using organic fertilizer. Regular planting distance will have an impact on increasing the size of vegetables when harvested. The use of organic fertilizer will reduce the chemical content in vegetables. Consumers will prefer vegetables with low chemical content. Quality improvement is considered possible for vegetable farmers.

4. Government Assistance

City Government Assistance is still expected by vegetable farmers. Increasing subsidies for manufactured fertilizers can reduce the cost of purchasing fertilizers. However, farmers often experience obstacles in purchasing subsidized fertilizers due to rationing through membership in farmer groups. Fertilizer purchases must have a definitive group needs plan book (RDKK).

5. Organic fertilizer

The use of fertilizer by farmers aims to reduce the use of manufactured fertilizers so that it can reduce costs and aims to restore soil fertility. Fertilizers are obtained from chicken farms located around the vegetable horticulture agribusiness area of Tomohon City. The highest use of manure is in cabbage, followed by mustard greens and the lowest in carrots.

6. Plant Rotation

Crop rotation can be done if you have planted similar vegetables in succession. Planting carrots in succession will cause soil fertility to decrease so that farmers replace them by planting cabbage and mustard greens.

7. Capital Loan

Farmers only borrow capital when they lack capital. Sufficient capital availability only occurs when the income from vegetable sales in the previous period is small. Low income is more due to low vegetable prices and not due to low production.

8. Pest and Disease Control

Intensive pest and disease control only in the dry season. During the dry season, cabbage and mustard greens have the highest level of pest and disease attacks. Farmers control pests and diseases by using pesticides. Farmers do not consider pest and disease attacks as a threat in vegetable farming activities.

CONCLUSION

The priority superior commodities in the development of the Sustainable Vegetable Horticulture Agribusiness Area in Tomohon City consist of the first priority carrots, the second priority mustard greens and the third priority cabbage. Factors that are a priority in the development of Sustainable Vegetable Horticulture Agribusiness Areas in Tomohon City with the priority order of land conditions, high prices, productivity, low capital, limited labor, limited production facilities, out-of-town marketing, local marketing, government programs, out-of-town products, product damage and pests and diseases. Development Strategy with priority order of increasing production, increasing marketing, increasing quality, government assistance, organic fertilizer ,

crop rotation, capital loans, pest and disease control.

ACKNOWLEDGMENT

Gratitude is extended to the Indonesian government via LPPM Sam Ratulangi University for the allocation of the research grant PNBP in 2024.

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BPS, Tomohon City in Figures 2022.

BPS, Tomohon City in Figures 2024.

BPS, East Tomohon District in Figures 2022.

BPS, North Tomohon District in Figures 2022.

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