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Integration of SWOT Analysis and Analytical Hierarchy Process (AHP) in Determining the Location of Pamelo Orange Processing Industry in Pangkep Regency

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Abstract: Until now, many analyzes have been carried out to determine the right industrial location. However, there has been no attempt to combine SWOT analysis and the Analytical Hierarchy Process (AHP) in this context. This study aims to determine a strategic location as a place to establish a pomelo orange processing industry in Pangkep Regency by integrating SWOT and AHP analysis. The factors in the SWOT analysis were obtained through interviews with various related parties, followed by the distribution of the SWOT and AHP questionnaire surveys to 5 respondents who were considered experts in their fields, consisting of 3 management lecturers from the Pangkep State Agricultural Polytechnic and 2 parties from the Department of Agriculture and the Department of Agriculture. Pangkep Regency Industry. The results of the SWOT and AHP analysis reveal 6 factors that have high priority in determining the location of the pomelo orange processing industry in Pangkep Regency, namely raw material availability, land availability, distance from the city center, taxation aspects, support from the local government, and legality factors. Based on the conclusions of these six priority factors, it can be suggested that the most strategic location for the pomelo orange processing industry in Pangkep Regency is in Ma'rang District.

Keywords: Analytical hierarchy process (AHP); Industrial location; Pamelo processing; SWOT analysis

Introduction

With the implementation of regional autonomy, each regional government is faced with demands to take advantage of various superior potentials in efforts to implement regional autonomy and increase the income and welfare of citizens (Maulana et al., 2022). In this context, the agricultural sector, especially the plantation sub-sector, has a significant role in increasing regional income. The integration between the agricultural and industrial sectors is expected to provide added value and increase competitiveness (2022). Pangkajene and Islands Regency (Pangkep) is known as one of the pomelo citrus production centers in South Sulawesi Province (Al-Amanah et al., 2022). Data from the Central Bureau of Statistics of South Sulawesi shows that in 2020, pomelo orange production in Pangkep Regency will reach 23,912 tons (El-Khalifa et al., 2022). However, efforts to process pomelo citrus agricultural products in the region are still limited to the stage of providing raw materials (Supply) for the industry (Gamonpilas et al., 2021). This situation is caused by the regional government not having determined the location of the pomelo orange processing industry.

In facing the fact that agricultural products are easily damaged and bulky, determining the location of the processing industry becomes very important. In facing the fact that agricultural products are easily

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damaged and bulky, determining the location of the processing industry becomes very important (Dhanaraju et al., 2022). The success of choosing the right location will optimize efficiency in production and marketing, and will ultimately encourage regional economic growth (Farida & Setiawan, 2022).

As a response to these challenges, various analyzes have been carried out in determining industrial locations. However, until now there is no approach that combines SWOT analysis and AHP in this process. SWOT analysis is generally used to evaluate the internal and external environment simultaneously, providing a systematic framework and guidance in decision making (Alojail et al., 2023). However, in practice, SWOT analysis has a subjective aspect and it is sometimes difficult to measure the relative importance of various factors (Pereira et al., 2021). Therefore, there is a need to incorporate the AHP (Analytical Hierarchy Process) method in order to overcome the limitations of SWOT analysis.

There are several related studies, such as those conducted by, which uses the AHP method to deal with problems with multiple criteria, by combining it with SWOT analysis as a tool to determine internal and external factors in producing strategic planning. The purpose of the research (Fahim et al., 2021). to formulate strategic planning based on strengths, weaknesses, opportunities and threats, as well as identify strategic efforts made by the Telkom Purwokerto Institute of Technology (TPIT) and the Telkom Jakarta Institute of Technology (TJIT) in improving the criteria of excellence in Webometrics. The results showed that in TPIT, the weight of strength was 60%, weakness was 11%, opportunity was 15%, and threat was 14%, with the most important alternative sub-criteria for strength being writing culture for lecturers, students and staff, with a priority value of 39%. Other priorities, ranked by priority level, include the quality and credibility of private tertiary institutions, changes in Webometrics assessments, and lack of collaboration between lecturers.

Meanwhile, the SWOT priority in TPIT has a strength weight of 43%, 12% weakness, 37% opportunity, and 8% threat, with the most important alternative sub-criteria for strength being quarterly monitoring based on contract management, with a priority value of 21%. Other alternatives that can increase excellence in TJIT include maximizing efforts related to private tertiary institutions under the Telkom Education Foundation, overcoming research culture gaps, and improving competitors' research culture. Besides that, (Wijaya & Purnomo, 2022). using SWOT analysis and the AHP method, conducting preliminary observations and research with the aim of developing Warkop Meteora Al-Berkah Limo so that it can compete with other businesses. Research findings and discussions conducted by the authors lead to the conclusion that currently Warkop Meteora Al-Berkah Limo is more prone to weaknesses and threats (WT). Therefore, the right SWOT strategy to advance the Warkop Meteora Al-Berkah Limo business is to minimize threats and weaknesses (W-T), so that improvements are needed in areas of weakness to avoid potential threats. Strategies that can be used include increasing employee friendliness, providing facilities such as a special relaxation area or relaxation room, offering free WiFi access, and installing air conditioning to create a comfortable and different atmosphere from similar business establishments.

Based on the explanation above, through this research it is hoped that Pangkep Regency will be able to determine the location of the pomelo orange processing industry which does not only play a role in providing raw materials, but also contributes to increasing added value and competitiveness.

Method

Place and Time of Study

This research was conducted for three months, from June to August 2023, and is located in Pangkep Regency. In the effort to collect secondary data, several offices participated as research locations, including the Pangkep Regency Office of Cooperatives, SMEs, Trade & Industry, Pangkep Regency Agriculture Service, and the Pangkep Regency Central Statistics Agency.

Research Instruments

In this study, a number of instruments were used to support data collection and analysis. These instruments include the use of cell phones as a tool for recording interview results and research documentation, the use of questionnaires as a means of collecting data, and the use of laptops as a tool for analyzing and compiling the data that has been collected. By utilizing these instruments, research can be carried out more efficiently and accurately.

Research Design

This research adopts a descriptive quantitative research design, which focuses on an empirical approach. This descriptive quantitative approach is based on the facts found from the object of observation, with the aim of providing a systematic, factual, and accurate description.

Research Procedure

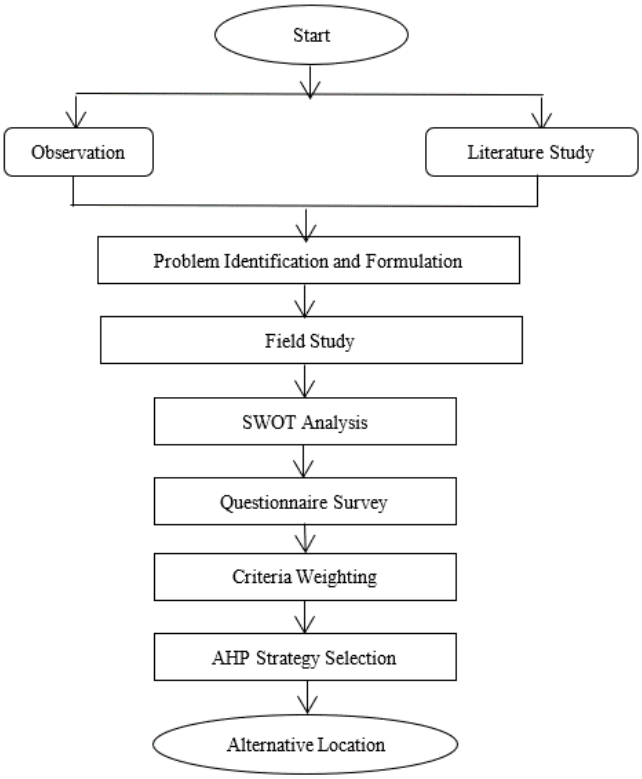

Figure 1. Flowchart of research procedures

Data Types and Sources

The type of data used in this research is quantitative and qualitative data. Meanwhile, the data sources used include primary data and secondary data. Primary data was obtained through interviews and observations, while secondary data was obtained from the Central Bureau of Statistics (BPS) for Pangkajene and Islands Districts.

Data Collection Technique

The data collection stage is the core of conducting research, because the main goal is to obtain relevant data. In the context of this study, several data collection techniques were used, namely observation for direct observation of the phenomenon under study, literature study to analyze SWOT, AHP, and their combinations in order to gain in-depth insights, as well as interviews with related parties which were conducted directly to obtain views and more detailed information about the key factors in the research (Pessoa et al., 2019). The combination of these techniques provides a comprehensive and quality data base, enabling in-depth analysis of the aspects that are the main focus of the research (Rashid et al., 2019).

Data Analysis Technique

SWOT Analysis

SWOT analysis is used to determine the factors that are grouped into four sections, namely strengths, weaknesses, opportunities, and threats in each SWOT group. The application of SWOT in strategic decisions aims to choose or establish and implement strategies that produce a good fit between internal and external factors. The results of the analysis of internal and external factors are then mapped into the SWOT matrix so that it is easy to analyze as a form of effort to increase the ranking on the criteria for determining the location of the pomelo orange processing industry in Kab. Pangkep.

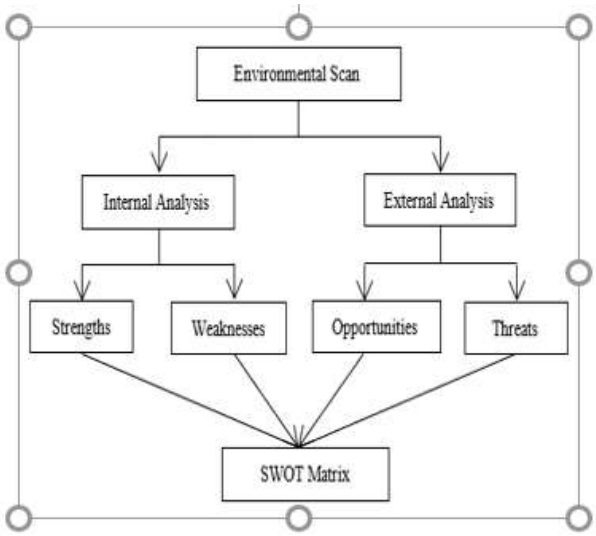

Figure 2. SWOT analysis framework

AHP Analysis

AHP is one of the analytical methods used to make decisions from various alternatives by considering the complexity of the problem in a simple, creative, flexible way (Haavold & Sriraman, 2022), while still ensuring the consistency of the resulting decisions. Basically, the AHP method seeks to break down a complex, unstructured situation into smaller components (Muanley et al., 2022). This method arranges the sections or variables in a hierarchy, assigns a numerical value to subjective judgments about the relative importance of each variable, and synthesizes these considerations to determine which variable has the highest priority and the next action to be taken (Snyder, 2019). In using this method, decision making refers to a group of criteria based on a comparison (comparison matrix) (Widianta et al., 2018). The three basic principles used in the AHP method include setting up a hierarchy, setting priorities, and giving weights (Esen, 2023). To apply these three basic principles, a pairwise comparison technique is used with a scale of 1-9 as shown in Table 1.

Table 1. Rating Number Scale

Mark	Definition
1	One attribute to another is equally important
3	One attribute is slightly more important (rather strong) than the other attributes
5	One attribute is more important than the other attributes
7	One attribute is much more important than the other attributes
9	One attribute is absolutely more important than the other attributes
2,4,6,8	If the attribute i compared to j gets a non-zero value, then j when compared to i has the opposite value.

SWOT-AHP Method

The purpose of using AHP within the SWOT framework is to systematically evaluate SWOT factors and measure their intensity quantitatively. When combined with AHP, the SWOT approach can produce a quantitative measure of the importance of each factor in decision making. SWOT and AHP integration is carried out through the following four stages (Mor et al., 2019):

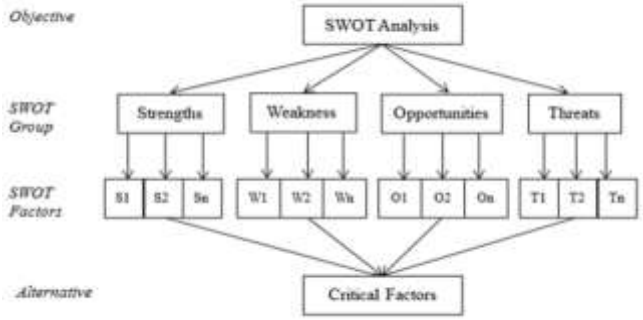

Figure 3. SWOT matrix hierarchical structure

In the SWOT and AHP integration process, the following steps are executed:

Stage 1: SWOT Analysis

Relevant factors from the internal and external environment are identified and incorporated into the SWOT analysis. Attempts were made to limit the number of factors not to exceed 10, so that pairwise comparisons are not too complex. The results of the pairwise comparisons provide a quantitative value that reflects the priority of each factor in the SWOT analysis.

Stage 2: Pairwise Comparison of the SWOT Factors in Each Group

Pairwise comparisons were performed on the factors within each of the SWOT groups. At this stage, the basis for comparison is (i) between the two factors being compared, which one has a greater influence as a strength, weakness, opportunity or threat, and (ii) how big the influence is. The results of this comparison are used to calculate the local priority of the factors with the eigenvalue method. This priority value reflects the expert's view of the relative importance of these factors.

Stage 3: Pairwise Comparisons Between the Four SWOT Groups

The factor with the highest local priority was selected from each SWOT group to represent that group. Pairwise comparisons were made on these four factors, following the steps in step 2. The resulting priority scores reflect the relative importance of the SWOT groups. This priority value is multiplied by the priority value of each factor from stage 2 to produce a global priority value. The sum of the global priority values for all factors is one (Barrichello et al., 2020).

Stage 4: Utilization of Results for Strategy Formulation, Planning, and Other Needs

The numerical value obtained reflects the level of influence or the level of relative importance of the factors, both within the SWOT group and between SWOT groups. These values can be used to set priorities in determining the location of the pomelo orange processing industry in Pangkep Regency.

Result and Discussion

Identification of Factors in Determining the Location of Pamelo Orange Processing Industry in Pangkep Regency

Based on the results of interviews that have been conducted with several parties, the SWOT factor variable is obtained which is related to determining the location of the pomelo orange processing industry in Pangkep Regency. This variable consists of 5 strength factors, 3 weaknesses factors, 5 opportunity factors, and 3 threat factors. The following is a table that displays the factor variables.

Table 2. SWOT Factor Variables Determining the Location of Pamelo Orange Processing Industry in Pangkep Regency

Code	Internal factors
	Strengths
S1	Abundant availability of raw materials
S2	Local labor available
S3	Availability of land
S4	Adequate energy source
S5	Easy transportation access
	Weaknesses
W1	Competent Human Resources are relatively low
W2	Lack of innovation in processed pomelo citrus products

Code	Internal factors
W3	The distance from the city center is quite far
	External Factors
	Opportunities
Q1	Increase employment
Q2	Lack of pomelo orange processing industry in Kab. Pangkep
Q3	Lower taxes
Q4	An industry expansion (expansion) plan is easy to make
Q5	There is support from the local government
	Threats
T1	Location on the edge of town
T2	Local statutory policies
T3	Legality is hard to come by

After conducting an analysis of internal and external factors, the next step involves compiling the IFAS (Internal Factor Analysis Summary) and EFAS (External Factor Analysis Summary) matrices related to determining the location of the pomelo orange processing industry in Pangkep Regency. To assess the score of each SWOT factor, respondents will be asked to fill out a questionnaire detailing their level of agreement with these factors, using the assessment criteria according to (Nowell et al., 2017) which consists of a value scale: 1 = Very Low, 2 = Low, 3 = High, and 4 = Very High. Based on the results of the questionnaire survey that was distributed to 5 respondents, the results obtained are in the following table.

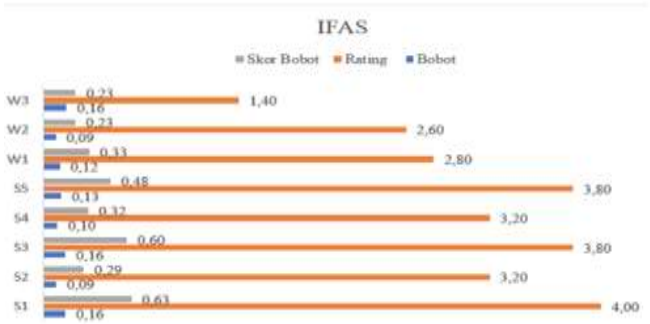

Figure 4. IFAS diagrams

Table 3. Rating Number Scale

Mark		Weight	Ratings	Weight Score
	Strength			
S1	Abundant availability of raw materials	0.16	4.00	0.63
S2	Local labor available	0.09	3.20	0.29
S3	Availability of land	0.10	3.20	0.32
S4	Easy source of transportation	0.10	3.20	0.32
S5	Transportation access	0.13	3.80	0.48
	Strength amount			2.32
	Weaknesses			
W1	Competent human resources are relatively low	0.12	2.80	0.33
W2	Lack of innovation in processed pomelo citrus products	0.09	2.60	0.23
W3	The distance from the city center is quite far	0.16	1.40	0.23
	Number of Weaknesses			0.78

Table 4. Rating Score Scale

Mark		Weight	Rating	Score Weight
	Opportunity			
Q1	Increase employment	0.13	3.60	0.46
Q2	Lack of pomelo orange processing industry in Pangkep Regency	0.11	2.80	0.31
Q3	Lower taxes	0.20	2.40	0.48
Q4	An industry expansion (expansion) plan is easy to make	0.08	3.20	0.24
Q5	There is support from the government	0.14	3.80	0.55
Q1	Number of Opportunities			2.32
	Threats			
T1	Location on the edge of town	0.09	1.80	0.17
T2	Local statutory policies	0.11	2.40	0.27
T3	Legality is hard to come by	0.14	2.40	0.33
	Number of Threats			0.76

In Figure 5, it is explained that the number of ratings is obtained from the average calculation of the results of the SWOT questionnaire survey conducted by five expert respondents. This rating assessment was carried out by involving five respondents who were considered to have expertise in related fields, consisting of three management lecturers from the Pangkep Politani and two representatives from the Pangkep District Agriculture Office and Industry Service Office

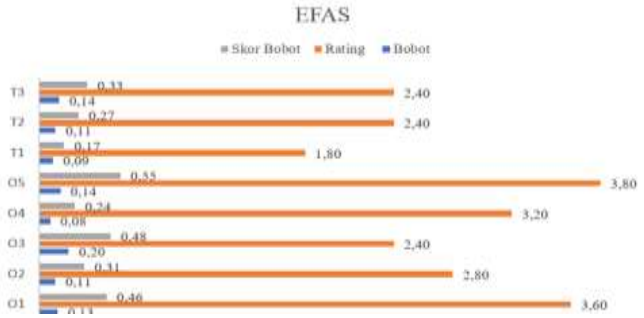

Figure 5. EFAS diagram

SWOT Matrix Depiction

Matrix drawing is used to determine the position of the strategy for determining the location of the pomelo orange processing industry in the SWOT matrix using the IFAS and EFAS methods. SWOT analysis is intended to identify various factors to formulate a strategy. Based on data from internal and external factors in the previous table, the total values of the SWOT factors are obtained as follows: strength factor = 2.32; weakness factor (weakness) = 0.78; opportunity factor (opportunity) = 2.04; and threats factor (threat) = 0.76. From the weighting scores described above, the x and y values which will be the coordinate points in the SWOT analysis chart for determining the location of the pomelo orange processing industry in Pangkep Regency can be determined. To calculate x and y values, the steps are as follows:

X = Strength Score – Weakness Score (1)
= 2.32 – 0.78 = 1.54
Y = Opportunity Score – Threat Score (2)
= 2.04 – 0.76 = 1.28

Thus, the coordinate points for the SWOT analysis chart for determining the location of the pomelo orange processing industry are (1.54; 1.28). From Figure 6 the SWOT matrix for determining industrial location, it can be concluded that the position of the industrial location is in quadrant I, which indicates the adoption of an aggressive strategy. This position describes a very favorable situation because there is a balance between opportunity and strength factors (Bavel et al., 2020). That is, this condition allows the utilization of existing opportunities to further enhance the strengths possessed.

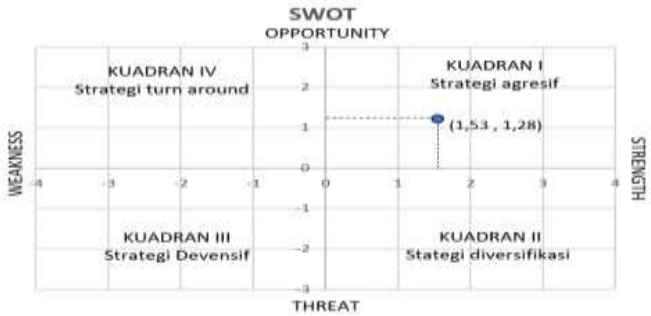

Figure 6. Graph of SWOT analysis determining industrial locations

Location Determination Strategy Weighting with AHP

The next step is to carry out a strategy analysis using the AHP method by using internal and external factors that have previously been used in the SWOT method. The weighting in AHP is carried out based on the results of pairwise comparisons between criteria and alternatives, in accordance with the results of the SWOT analysis obtained through interviews with relevant parties, including the Department of Agriculture, Office of Cooperatives, SMEs, Industry & Trade, and the Pangkep District Central Statistics Agency.

The resulting pairwise comparison matrix is then assessed through the matrix normalization process. Normalization is done by dividing each value in the column by the total value of each SWOT factor. After normalization is complete, proceed with calculating the weight or Priority Vector. This weight is obtained by calculating the average of the sum of each value. Details of the normalization and weighting results on the SWOT criteria can be found in the following table:

Table 5. Paired Comparison Matrix of Internal Factors

	S1	S2	S3	S4	S5	W1	W2	W3
S1	1.00	1.42	0.98	2.35	1.48	2.29	1.25	3.30
S2	1.42	1.00	0.45	1.22	0.56	1.18	0.54	1.79
S3	0.98	0.45	1.00	2.35	2.30	2.37	1.52	3.39
S4	2.35	1.22	2.35	1.00	0.45	0.69	0.61	0.54
W1	1.48	0.56	2.30	0.45	1.00	1.95	1.55	2.79
W2	2.29	1.18	2.37	0.69	1.95	1.00	0.45	1.28
W3	1.25	0.54	1.52	0.61	1.55	0.45	1.00	1.25
	3.30	1.79	3.39	0.54	2.79	1.28	1.25	1.00
Amount	14.06	8.16	14.35	9.22	12.07	11.21	8.17	15.34

Table 6. Paired Comparison Matrix of External Factors

	Q1	Q2	Q3	Q4	Q5	T1	T2	T3
O1	1.00	0.61	6.36	0.78	0.23	0.44	0.33	0.76
O2	0.61	1.00	6.00	0.59	0.19	0.31	0.23	0.52
O3	6.36	6.00	1.00	0.31	0.29	0.30	0.39	0.68
O4	0.78	0.59	0.31	1.00	0.18	0.35	0.36	0.52
Q5	0.23	0.19	0.29	0.18	1.00	1.31	2.35	2.77
T1	0.44	0.31	0.30	0.35	1.31	1.00	0.82	0.90
T2	0.33	0.23	0.39	0.36	2.35	0.82	1.00	1.12
T3	0.76	0.52	0.68	0.52	2.77	0.90	1.12	1.00
Total	10.50	9.45	15.32	4.10	8.32	5.43	6.60	8.26

Figure 7. Result diagram of pairwise comparison matrix of internal factors

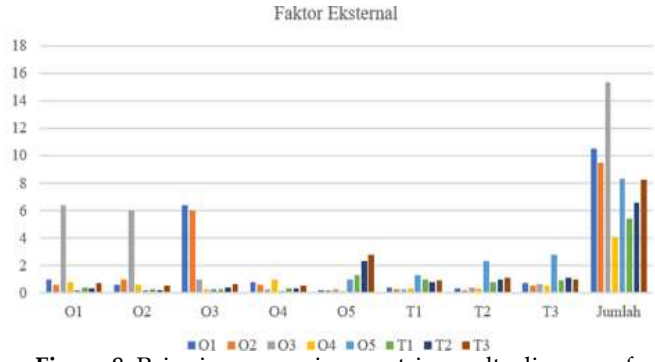

Figure 8. Pairwise comparison matrix results diagram of external factors

After completing the process of determining the matrix value for each sub-criteria, the next step is to normalize it. This normalization process aims to determine the weight or priority of the criteria for internal factors and external factors in determining the location of the pomelo orange processing industry in Pangkep Regency. Weighting is done by calculating the ratio between the number of values on internal factors and external factors with the number of criteria (n). Furthermore, the normalized value for each element of the SWOT factor is calculated based on the division between the values in each criterion i and j with the total value in the corresponding column, according to the following formula:

$$a=aij/(\Sigma aij) \quad (3)$$

Based on Mahera (2022), consistency testing is carried out through matrix calculations using the Consistency Index (CI) to assess the level of consistency of the assessments that have been given. The CI value is then used to calculate the Consistency Ratio (CR) with the following formula:

$$CI = \frac{\lambda\, maks - n}{n-1} \leq 0.1 \quad (4)$$

$$CR = \frac{CI}{RI} \leq 0.1 \quad (5)$$

Table 7. Internal Factor Normalization Comparison Matrix

										Normalization	
	S1	S2	S3	S4	S5	W1	W2	W3	Amount	Priority vectors	The x priority matrix	Consistency
S1	0.07	0.17	0.07	0.26	0.12	0.20	0.15	0.22	1.26	0.16	1.78	11.28
S2	0.10	0.12	0.03	0.13	0.05	0.11	0.07	0.12	0.72	0.09	1.06	11.71
S3	0.07	0.06	0.07	0.26	0.19	0.21	0.19	0.22	1.26	0.16	1.84	11.72
S4	0.17	0.15	0.16	0.11	0.04	0.06	0.08	0.04	0.80	0.10	1.23	12.34
S5	0.10	0.07	0.16	0.05	0.08	0.17	0.19	0.18	1.01	0.13	1.64	12.95
W1	0.16	0.15	0.17	0.07	0.16	0.09	0.06	0.08	0.94	0.12	1.52	12.99
W2	0.09	0.07	0.11	0.07	0.13	0.04	0.12	0.08	0.70	0.09	1.09	12.41
W3	0.23	0.22	0.24	0.06	0.23	0.11	0.15	0.07	1.31	0.16	2.04	12.47
												CR = 0.43

If the results of the Consistency Ratio (CR) ≤ 0.1, it can be concluded that the answers given by experts are consistent, so that the decisions taken have the potential to produce optimal solutions. Based on Table 7, it can be seen that there are three priority vectors with the highest weight, namely on the criteria S1 (Availability of raw

materials), S3 (Availability of land), and W3 (Distance from the city center). However, when looking at the CR value in the internal factor normalization comparison matrix, a value of 0.43 is found which is greater than 0.1 (Alfalah et al., 2023). This indicates that the answers given by experts on internal factors are inconsistent, and the resulting solutions are not optimal. Maybe this is caused by an inappropriate choice of one of the SWOT factor criteria.

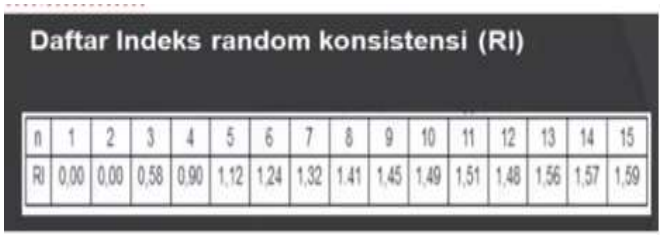

Figure 9. List of consistency random indices

Table 8. External Factor Normalization Comparison Matrix

	O1	O2	O3	O4	O5	T1	T2	T3	Amount	Priority vectors	Normalization The x priority matrix	Consistency
O1	0.10	0.06	0.41	0.19	0.03	0.08	0.05	0.09	1.02	0.13	1.75	13.77
O2	0.06	0.11	0.39	0.14	0.02	0.06	0.03	0.06	0.88	0.11	1.59	14.54
O3	0.61	0.63	0.07	0.08	0.03	0.06	0.06	0.08	1.61	0.20	1.89	9.40
O4	0.07	0.06	0.02	0.24	0.02	0.06	0.05	0.06	0.61	0.08	0.47	6.24
O5	0.02	0.02	0.02	0.04	0.12	0.24	0.36	0.33	1.16	0.14	1.03	7.10
T1	0.04	0.03	0.02	0.09	0.16	0.18	0.12	0.11	0.75	0.09	0.67	7.15
T2	0.03	0.02	0.03	0.09	0.28	0.15	0.15	0.14	0.89	0.11	0.85	7.67
T3	0.07	0.05	0.04	0.13	0.33	0.17	0.17	0.12	1.09	0.14	1.07	7.91
												CR = 0.12

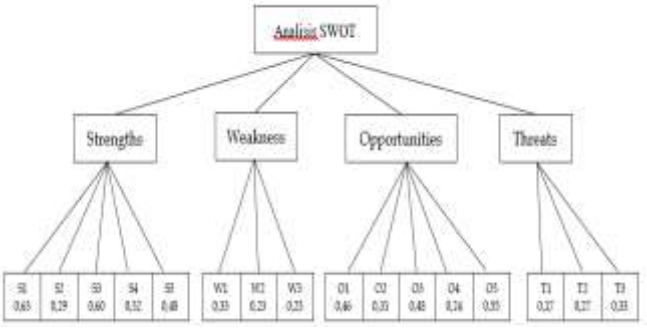

Figure 10. SWOT matrix hierarchical structure

Based on Table 8, it can be seen that there are 3 priority vectors with the highest weight in the comparison matrix of normalization of external factors determining the location of the pomelo orange processing industry in Pangkep Regency, namely on criteria O3 (Tax), O5 (Pemda Support), and T3 (Legality). Furthermore, when looking at the CR value in the external factor normalization comparison matrix, a value of 0.12 is found which is smaller than 0.1 (Sevinç et al., 2018). This indicates that the answers given by experts on external factors are consistent and can produce optimal solutions. From the results of the analysis, six factors were identified with the highest level of priority from internal and external factors which would determine the location of the pomelo orange processing industry in Pangkep Regency. Seminara et al. (2023) states that these factors are top priorities that need to be maintained and developed. These factors include:

Table 9. Rating Score Scale

SWOT factor		Weight
Availability of Raw Materials	S1	0.16
Land Availability	S3	0.16
Distance from City Center	W3	0.16
Tax	Q1	0.20
PEMDA support	Q5	0.14
Legality	T3	0.14

Based on the consideration of the six priority vectors with the highest weight, it can be concluded that the most strategic location for the pomelo orange processing industry in Pangkep Regency is in Ma'rang District. This sub-district has a very abundant availability of raw materials, with productivity reaching 24 tons per year based on data from the Pangkep Regency Agriculture Office. In addition, the area of land in Ma'rang District is also competitive compared to other districts (Erenstein et al., 2022). The relatively close distance from the city center, only about 14.8 km, is also another advantage. In addition to these aspects, from a tax perspective, the location of Ma'rang District, which is not located in the city center, provides a potential advantage for the development of this industry (Coman et al., 2020). What's more, there is real support from the Regional Government regarding this business in the pomelo orange processing sector, as seen from data on equipment grants and supporting facilities for small and medium sized pomelo processing businesses in Pangkep Regency.

Conclusion

The conclusions from the research on Determining the Location of Pamelo Orange Processing Industry with the SWOT and AHP Combination Method are as follows. First, determining the location of the pomelo orange processing industry in Pangkep Regency using the SWOT and AHP combination method was carried out by identifying the SWOT factor variables and then weighting them using the AHP method to obtain the priority level. Second, based on the SWOT and AHP analysis, 6 factors were found that had high priority in determining the location of the pomelo orange processing industry in Pangkep Regency, namely raw material availability, land availability, distance from the city center, taxation aspects, support from local government, and legality factors. . Third, from the six priority factors, it can be concluded that the most strategic location for the pomelo orange processing industry in Pangkep Regency is Ma'rang District. The suggestion that the researcher can provide is for future research to analyze or determine internal and external factors in a more thorough and comprehensive manner, so that the results obtained can be more satisfactory.

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The authors declare no conflict of interest.

References

Al-Amanah, H., Sjahril, R., Haring, F., Riadi, M., & Larekeng, S. H. (2022). Mapping distribution of Capsicum annum var. Chinense in Tana Toraja and surrounding districts (Indonesia) based on fruit morphology. *Biodiversitas Journal of Biological Diversity*, *23*(2). https://doi.org/10.13057/biodiv/d230241

Alfalah, G., Alasaibia, A., Alshamrani, O., & Al-Sakkaf, A. (2023). A Holistic Framework for Assessing the Quality of Building Construction in Saudi Arabia. *Buildings*, *13*(7), 1666. https://doi.org/10.3390/buildings13071666

Alojail, M., Alturki, M., & Bhatia Khan, S. (2023). An Informed Decision Support Framework from a Strategic Perspective in the Health Sector. *Information*, *14*(7), 363. https://doi.org/10.3390/info14070363

Barrichello, A., Santos, E. G. D., & Morano, R. S. (2020). Determinant and priority factors of innovation for the development of nations. *Innovation & Management Review*, *17*(3), 307–320. https://doi.org/10.1108/INMR-04-2019-0040

Bavel, J. J. V., Baicker, K., Boggio, P. S., Capraro, V., Cichocka, A., Cikara, M., Crockett, M. J., Crum, A. J., Douglas, K. M., Druckman, J. N., Drury, J., Dube, O., Ellemers, N., Finkel, E. J., Fowler, J. H., Gelfand, M., Han, S., Haslam, S. A., Jetten, J., … Willer, R. (2020). Using social and behavioural science to support COVID-19 pandemic response. *Nature Human Behaviour*, *4*(5), 460–471. https://doi.org/10.1038/s41562-020-0884-z

Coman, C., Țîru, L. G., Meseșan-Schmitz, L., Stanciu, C., & Bularca, M. C. (2020). Online Teaching and Learning in Higher Education during the Coronavirus Pandemic: Students' Perspective. *Sustainability*, *12*(24), 10367. https://doi.org/10.3390/su122410367

Dhanaraju, M., Chenniappan, P., Ramalingam, K., Pazhanivelan, S., & Kaliaperumal, R. (2022). Smart Farming: Internet of Things (IoT)-Based Sustainable Agriculture. *Agriculture*, *12*(10), 1745. https://doi.org/10.3390/agriculture12101745

El-Khalifa, Z. S., ElSheikh, M. H., Zahran, H. F., & Ayoub, A. (2022). Evaluation of Washington Navel Orange Economic Indicators. *Open Journal of Applied Sciences*, *12*(04), 481–490. https://doi.org/10.4236/ojapps.2022.124033

Erenstein, O., Jaleta, M., Sonder, K., Mottaleb, K., & Prasanna, B. M. (2022). Global maize production, consumption and trade: Trends and R&D implications. *Food Security*, *14*(5), 1295–1319. https://doi.org/10.1007/s12571-022-01288-7

Esen, H. (2023). Analytical Hierarchy Process Problem Solution. In *Analytic Hierarchy Process – Models, Methods, Concepts, and Applications [Working Title]*. IntechOpen. https://doi.org/10.5772/intechopen.1001072

Fahim, A., Tan, Q., Naz, B., Ain, Q. U., & Bazai, S. U. (2021). Sustainable Higher Education Reform Quality Assessment Using SWOT Analysis with Integration of AHP and Entropy Models: A Case

Study of Morocco. *Sustainability*, *13*(8), 4312. https://doi.org/10.3390/su13084312

Farida, I., & Setiawan, D. (2022). Business Strategies and Competitive Advantage: The Role of Performance and Innovation. *Journal of Open Innovation: Technology, Market, and Complexity*, *8*(3), 163. https://doi.org/10.3390/joitmc8030163

Gamonpilas, C., Buathongjan, C., Kirdsawasd, T., Rattanaprasert, M., Klomtun, M., Phonsatta, N., & Methacanon, P. (2021). Pomelo pectin and fiber: Some perspectives and applications in food industry. *Food Hydrocolloids*, *120*, 106981. https://doi.org/10.1016/j.foodhyd.2021.106981

Haavold, P. Ø., & Sriraman, B. (2022). Creativity in problem solving: Integrating two different views of insight. *ZDM – Mathematics Education*, *54*(1), 83–96. https://doi.org/10.1007/s11858-021-01304-8

Maulana, A., Utami, C., & Hanafi, L. I. (2022). The Progress of Regional Autonomy Policy and Development Attainments: Indonesia's Experience (1999-2021). *Jurnal Ilmu Administrasi: Media Pengembangan Ilmu Dan Praktek Administrasi*, *19*(1), 95–111. https://doi.org/10.31113/jia.v19i1.857

Mor, R., Bhardwaj, A., & Singh, S. (2019). Integration of SWOT-AHP Approach for Measuring the Critical Factors of Dairy Supply Chain. *Logistics*, *3*(1), 9. https://doi.org/10.3390/logistics3010009

Muanley, Y. Y., Son, A. L., Mada, G. S., & Dethan, N. K. F. (2022). Analisis Sensitivitas Dalam Metode Analytic Hierarchy Process dan Pengaruhnya Terhadap Urutan Prioritas Pada Pemilihan Smartphone Android. *VARIANSI: Journal of Statistics and Its Application on Teaching and Research*, *4*(3), 173–190. https://doi.org/10.35580/variansiunm32

Nowell, L. S., Norris, J. M., White, D. E., & Moules, N. J. (2017). Thematic Analysis: Striving to Meet the Trustworthiness Criteria. *International Journal of Qualitative Methods*, *16*(1), 160940691773384. https://doi.org/10.1177/1609406917733847

Pereira, L., Pinto, M., Costa, R. L. D., Dias, Á., & Gonçalves, R. (2021). The New SWOT for a Sustainable World. *Journal of Open Innovation: Technology, Market, and Complexity*, *7*(1), 18. https://doi.org/10.3390/joitmc7010018

Pessoa, A. S. G., Harper, E., Santos, I. S., & Gracino, M. C. D. S. (2019). Using Reflexive Interviewing to Foster Deep Understanding of Research Participants' Perspectives. *International Journal of Qualitative Methods*, *18*, 160940691882502. https://doi.org/10.1177/1609406918825026

Rashid, Y., Rashid, A., Warraich, M. A., Sabir, S. S., & Waseem, A. (2019). Case Study Method: A Step-by-Step Guide for Business Researchers. *International Journal of Qualitative Methods*, *18*, 160940691986242. https://doi.org/10.1177/1609406919862424

Seminara, S., Bennici, S., Di Guardo, M., Caruso, M., Gentile, A., La Malfa, S., & Distefano, G. (2023). Sweet Orange: Evolution, Characterization, Varieties, and Breeding Perspectives. *Agriculture*, *13*(2), 264. https://doi.org/10.3390/agriculture13020264

Sevinç, A., Gür, Ş., & Eren, T. (2018). Analysis of the Difficulties of SMEs in Industry 4.0 Applications by Analytical Hierarchy Process and Analytical Network Process. *Processes*, *6*(12), 264. https://doi.org/10.3390/pr6120264

Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of Business Research*, *104*, 333–339. https://doi.org/10.1016/j.jbusres.2019.07.039

Widianta, M. M. D., Rizaldi, T., Setyohadi, D. P. S., & Riskiawan, H. Y. (2018). Comparison of Multi-Criteria Decision Support Methods (AHP, TOPSIS, SAW & PROMENTHEE) for Employee Placement. *Journal of Physics: Conference Series*, *953*, 012116. https://doi.org/10.1088/1742-6596/953/1/012116

Wijaya, J. & Purnomo. (2022). Analisis Strategi Pemasaran pada UMKM Depot Glory Dengan Menggunakan Metode Analytical Hierarchy Process (AHP). *Jurnal Teknik Industri UMC*, *1*(2), 124–137. https://doi.org/10.33479/jtiumc.v1i2.11

Yang, G., Zhou, C., & Zhang, J. (2022). Does industry convergence between agriculture and related sectors alleviate rural poverty: Evidence from China. *Environment, Development and Sustainability*. https://doi.org/10.1007/s10668-022-02594-y