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Strengthening Household Food Security Strategies in Jember Regency, Indonesia: A Multi Criteria Decision Analysis Approach

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Abstract. *Despite its great potential in the agricultural sector, Jember Regency faces various challenges in realizing food security. Such factors as the lack of infrastructure and support for food self-sufficiency, food vulnerability and insecurity, and the uneven distribution of food and nutrition become obstacles to food security services in Jember. This study aims to analyze strategies for improving food security in Jember Regency using the Multi-Criteria Decision Analysis approach. This study uses secondary and primary data. Secondary data was obtained from FSVA data (food vulnerability data per village), collected from the Jember Regency Development Planning Agency (Bappeda). Primary data was obtained from interviews and focus group discussions (FGD) with stakeholders related to food security in Jember Regency. Multi Criteria Decision Analysis, specifically the Analytical Hierarchy Process (AHP), was employed to analyze strategies for improving food security in Jember Regency. The results of the study indicate that the priority strategy for improving food security in Jember is to implement the Jember prosperous family card program and the 'One Village, One Food Barn Movement'. This strategy is considered the most effective in improving access, availability, and sustainable use of food. Therefore, the Jember government needs to focus on implementing the Prosperous Family Card Program and the "One Village, One Food Barn Movement" Initiative in an integrated manner, supported by data and accountable cross-sectoral coordination.*

Keywords: *food security; sustainable; village; food; strategy.*

Type of the Paper: Regular Article.

1. Introduction

Food security is an important condition in Indonesia, where food needs are met for the country and for individuals, as reflected in the availability of sufficient food, in accordance with Law No. 18/2012 on Food [1]. BPS data indicates that the average weekly per capita consumption of rice tends to decrease from 1.56 kg in 2023 to 1.52 kg in 2024 [2]. This decline is likely due to the increasing number of people who are becoming aware of food diversification. Based on BPS data 2025 [3], Indonesia's rice production has declined over the last three years, from 2022 to 2024. Meanwhile, the population growth rate is 1.25% per year according to data from the 2020 Indonesian population census conducted by BPS [4]. The data indicates that Indonesia's food needs will increase even though per capita consumption is declining. At the regional level, food security is an important indicator for evaluating a region's ability to meet the basic needs of its people and

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its adaptability to various threats such as climate change, natural disasters, and market fluctuations. Therefore, achieving stable and sustainable food security is a priority for regional development.

Jember Regency has great potential in the agricultural sector, but still faces various challenges in achieving food security. Rice production in Jember Regency in 2024 increased by 1.06% compared to 2023, but rice consumption in Jember declined from 11.67 kg capita^{-1} week^{-1} to 1.60 kg capita^{-1} week^{-1}. The data shows that food demand in Jember will increase even though per capita consumption is declining. Factors such as the lack of infrastructure and support for food self-sufficiency, issues of food vulnerability and insecurity, and uneven distribution of food and nutrition are obstacles to food security services in Jember [5]. In addition, economic disparities across various subdistricts/villages affect food security in the region, with some areas vulnerable to food shortages. This is consistent with the Food Security Index in Jember Regency, which has seen a slight decrease over the past three years but remains relatively low when compared to the national index in 2024. Jember's Food Security Index declined from 78.34 in 2022 to 77.43 in 2023, then dropped sharply to 67.67 in 2024, while the National Food Security Index rose from 71.97 to 74.31 before falling to 68.04.

Food security index data for Jember Regency for 2022–2024 show a significant decline, indicating that food security levels in Jember Regency still require continuous improvement. Therefore, research on strategies to improve food security in Jember Regency is neseded. Previous studies have discussed food security and factors that influence it in certain regions [6–9]. The studies have largely focused on factors influencing food security, and very few have addressed strategies for improving food security using a multi-criteria approach. The most important novelty of this research lies in its concrete contribution to policy and implementation at the local level. This research does not merely identify general food security issues, but successfully prioritizes highly specific and operational strategies for the context of Jember Regency, namely the Jember Family Welfare Card program and the One Village One Food Barn Movement. This novelty is significant because it fills the gap between macro planning and micro action and produces recommendations that can be directly adopted by local governments and stakeholders. Furthermore, this study promotes a holistic and participatory approach by integrating objective data on village-level food insecurity (FSVA) with subjective insights from key actors in the field through FGDs. This integration ensures that the resulting strategies are not only based on statistical evidence but also consider social realities, implementation feasibility, and acceptance by implementers, thereby increasing the relevance and potential success of these strategies in improving access, availability, and sustainable food utilization in Jember. This study aims to analyze strategies for improving food security in Jember Regency using the Multi-Criteria Decision Analysis approach.

2. Materials and Methods

This research was conducted in Jember Regency, which was deliberately selected because it is one of the centers of rice production (the fourth largest in East Java), but still has a relatively low food security index. This study uses secondary and primary data. Secondary data was obtained from Statistics Indonesia (BPS) and FSVA data (village-level food security data) obtained from the Jember District Development Planning Agency (Bappeda). The primary data for this study was collected through in-depth interviews with experts and Focus Group Discussions (FGD) with stakeholders involved in food security in Jember. Stakeholders related to food security include Bappeda of Jember Regency (Bappeda Kabupaten Jember), Population and Civil Registration Agency (Dinas Kependudukan dan Pencatatan Sipil), Food Security and Livestock Agency (Dinas Ketahanan Pangan dan Peternakan), Cooperatives and Micro, Small and Medium Enterprises Agency (Dinas Koperasi dan Usaha Mikro), Industry and Trade Agency (Dinas Perindustrian dan Perdagangan), Fisheries Agency (Dinas Perikanan), Social Affairs Agency (Dinas Sosial), Community and Village Empowerment Agency (Dinas Pemberdayaan Masyarakat dan Desa), Health Agency (Dinas Kesehatan), Food Crops, Horticulture and Plantation Agency (Dinas Tanaman Pangan, Hortikultura dan Perkebunan). The number of participants in the Focus Group Discussion (FGD) was 25, with each agency sending two participants, except for Bappeda, which sent seven.

Analysis of strategies to improve food security in Jember Regency using Multi Criteria Decision Analysis (MCDA). MCDA offers a key advantage in that it can address complex issues by taking into account various conflicting criteria (economic, social, environmental, infrastructure) in a structured and transparent manner. This method is flexible because it can combine quantitative data (such as FSVA data) and qualitative data (expert opinions from interviews/FGDs), as well as accommodate the diverse preferences of stakeholders by assigning weights to criteria according to their respective priorities. Through a systematic approach, MCDA helps decision-makers identify the best solutions or optimal compromises amid resource constraints, while enhancing the objectivity and accountability of policies because the entire decision-making process is well-documented [10]. MCDA can be used for ranking policy or strategy alternatives based on preference order. The MCDA employed in this study is the Analytical Hierarchy Process (AHP) [10,11]. The AHP technique was used to produce the criteria weights needed in processing MCDA, with respondents from agencies related to food security [12,13]. The assessment of food security improvement strategies is based on the assessment of food security aspects and indicators as shown in Table 1.

Table 1. Weight of AHP Result Criteria.

No	Indicator	Weight
	A. Food availability aspects	
1.	Agricultural land area ratio	0.60
2.	Food facilities ratio	0.40
	B. Food affordability aspects	
3.	Percentage of population below the poverty line	0.40
4.	Villages without access to transportation	0.30
5.	Percentage of households without electricity	0.30
	C. Food utilization aspects	
6.	Percentage of households without access to clean water	0.40
7.	Ratio of Population to Health Workers	0.30
8.	Percentage of Stunted Children	0.30

Source: [11,14].

The AHP method comprises the following steps [12, 13,15–17]:

1. Defining the problem and determining the desired solution
2. Creating a hierarchical structure as in AHP, starting with determining the objectives, then entering the food security aspect components at level 2, the indicators of each food security aspect component at level 3, and then entering the alternative strategies at level 4 (see Fig. 1).
3. Creating a pairwise comparison matrix that describes the relative contribution or influence of each element on the objective or criteria at the level above it. The pairwise comparison values can be seen in Table 2
4. Performing pairwise comparisons to obtain a total of $n \times [(n-1)/2]$ assessments, where n is the number of elements being compared.
5. Calculating the eigenvalues and test their consistency (the upper limit for the Consistency Ratio (CR) in the Analytic Hierarchy Process (AHP) is set at 0.10)
6. If inconsistent, repeat data collection
7. Repeating steps 3, 4, and 5 for the entire hierarchy
8. Calculating the eigen actor of each pairwise comparison matrix, which is the weight of each element at the lowest level of the hierarchy until the objective is reached.
9. Checking the consistency of the hierarchy

Table 2. Comparison scale of two pairs in AHP.

Importance score	Definition	Description
1	Same level of importance	Both strategies contribute equally to that goal.
3	Moderate difference in importance	One strategy is slightly more important than the others.
5	Strong importance	One strategy is more important than another.
7	Very important	One strategy is preferred over another; its dominance is demonstrated in practice.
9	Extremely important	The evidence supporting one strategy over another comes from the highest possible order of affirmation.
2, 4, 6, 8	Middle values	Middle values

Source: [12].

The AHP hierarchy can be seen on Fig. 1.

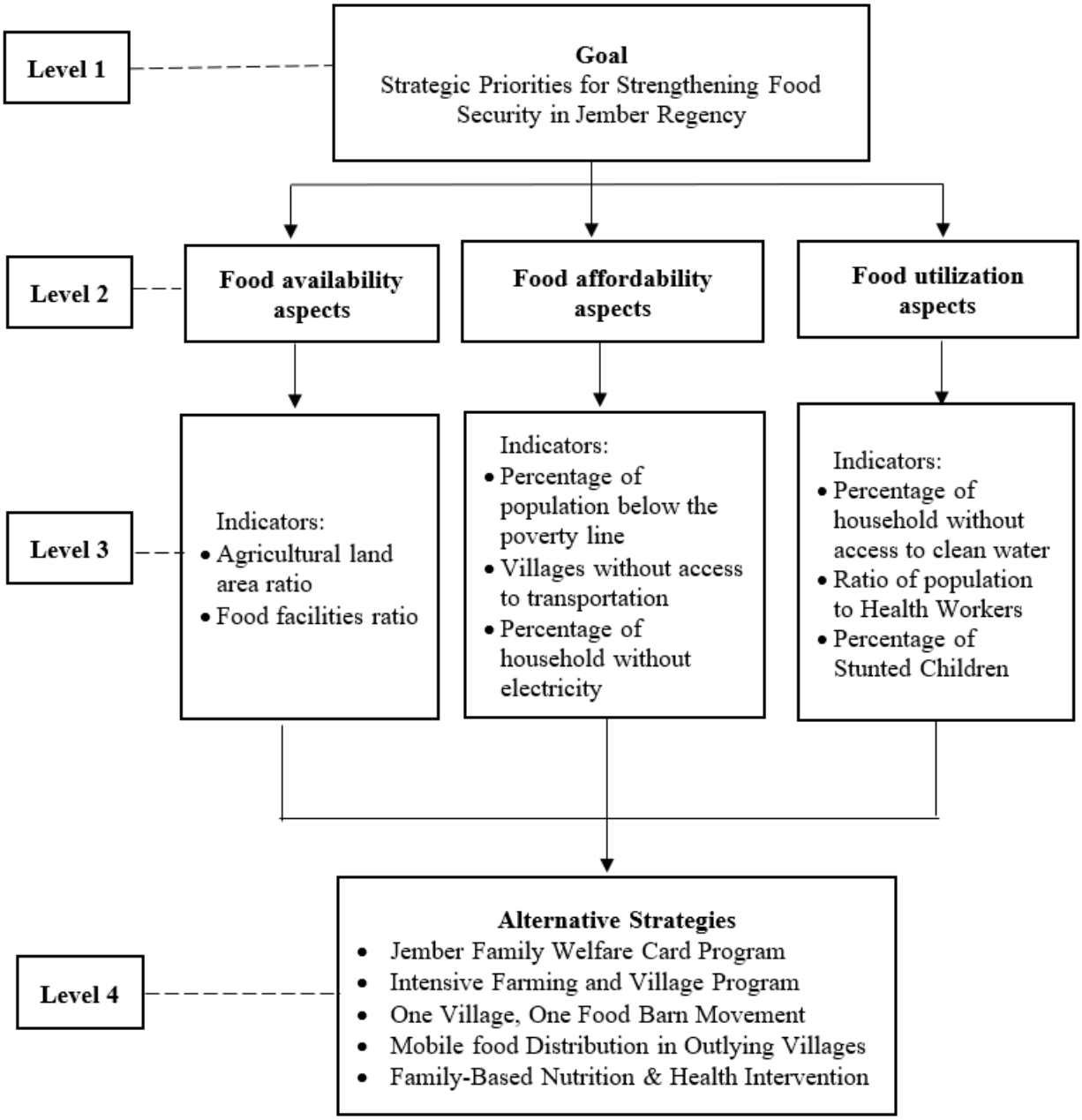


Fig. 1. AHP Hierarchy of Food Security Strengthening Strategies in Jember Regency.

3. Results and Discussion

Household food security is a condition in which food is available for the country and individuals, reflected in the availability of sufficient food in terms of quantity and quality, safety, diversity, nutrition, distribution, and affordability, and does not conflict with the religion, beliefs, and culture of the community, in order to live healthy, active, and productive lives in a sustainable manner [6,18–21]. The food security index (IKP) in Jember Regency based on FSVA data (food vulnerability data per village) shows that some villages in Jember Regency still face food insecurity issues (below 51.42) [14]. Therefore, an analysis of household food security strategies needs to be conducted using Multi-Criteria Decision Analysis. Multi-criteria decision analysis in this study uses the Analytical Hierarchy Process (AHP), which is employed to determine priority

strategies for improving food security in Jember Regency. The comparison in this AHP uses three comparisons, namely comparisons between aspects, comparisons between indicators, and comparisons between strategies.

3.1 Comparison of Food Security Aspects in Jember Regency

The main aspects of food security in Jember Regency include food affordability, food availability, and food utilization. The results of the AHP analysis show a very clear hierarchy of priorities, which can be seen in Table 3.

Table 3. Comparison of Food Security Aspects in Jember Regency.

	Category	Priority	Rank
1	Food availability	27.8%	2
2	Food affordability	66.3%	1
3	Food utilization	5.8%	3
	Consistency Ratio (CR)	0.056	

Source: Primary Data Processed (2025).

The main priority aspect is food affordability. Food affordability is the most important dimension, with a dominant priority score of 66.3%. This result shows that stakeholders consider the affordability of food for the community as the main problem in food security. This also illustrates the economic capacity of households to access or obtain food for their daily lives. Other factors that need to be considered in terms of affordability are people's purchasing power and economic access, which are considered the most critical obstacles requiring the most important intervention. These results are consistent with studies [22–29], which showed that food affordability is a key aspect of food security in several countries. Therefore, this aspect of affordability needs to be addressed by the government by equalizing access to food through several policies such as affordable markets or assistance to the community.

The second priority aspect is food availability, with a weight of 27.8%. Although it is the foundation of the food system in Jember Regency, availability is not an obstacle to achieving food security. Basically, food in Jember Regency is sufficiently available because Jember Regency is a center for food crops such as rice and corn. The implication is that policies that only focus on increasing food production without equitable access and distribution will not solve the problem of food insecurity in Jember Regency [30–32]. In addition, the aspect of food utilization is the last priority in achieving food security. This aspect of food utilization can be achieved through balanced nutrition, good food processing, and equitable public health status. The condition of food utilization in Jember Regency is considered good by stakeholders in Jember Regency [33]. So, it only ranks third in priority. The gap or disparity in the values of these three aspects indicates that the policies that need to be implemented in the regency to improve household food security should focus on government efforts to alleviate poverty, social security, and price stability as the main steps. The differences in the priority ratings across the three indicator aspects reflect the fact that

food utilization in Jember is already good, as is food availability; however, the indicator requiring further improvement is food affordability. In light of this, a strategy to improve food security in Jember Regency needs to be developed. Strategic steps to improve food security are discussed in the comparison of strategies.

3.2 Comparison of Food Security Indicators in Jember Regency

The comparative analysis of food security indicators in Jember Regency employed eight indicators, namely the ratio of agricultural land area, the ratio of food facilities, the percentage of people living below the poverty line, villages without access to transportation, the percentage of households without electricity, the percentage of households without clean water, the ratio of population to health workers, and the percentage of stunted children under five. The results of the AHP analysis on food security indicators can be seen in Table 4.

Table 4. Comparison of Food Security Indicators in Jember Regency.

	Category	Priority	Rank
1	Agricultural Land Ratio	9.6%	4
2	Food Facility Ratio	17.6%	2
3	Percentage of population below the poverty line	37.7%	1
4	Villages without access to transportation	14.0%	3
5	Percentage of households without electricity	4.0%	7
6	Percentage of households without access to clean water	5.2%	6
7	Ratio of population per health worker	3.9%	8
8	Percentage of stunted children	8.1%	5
	Consistency Ratio (CR)	0.088	

Source: Primary Data Processed (2025).

The most dominant food security indicator in Jember Regency is the percentage of people living below the poverty line. The contribution/weight of this indicator is 37.7%. This result shows that poverty is an indicator that needs to be addressed immediately in order to improve food security in Jember Regency. This issue is a core problem in food security development [34–39]. This indicator directly measures the economic capacity of households to access food and is the most sensitive benchmark. Based on these results, it appears that the indicator of the population below the poverty line remains a major obstacle [40], with Jember Regency having the second highest number of poor people in East Java in 2025 [41]. The implication is that the government needs to reduce the number of poor people in order to improve food security in Jember [42].

The next most significant indicators are the food facility ratio (17.6%) and villages without access to transportation (14.0%). These two indicators suggest that infrastructure and food distribution systems are crucial indicators that need to be addressed by the government [39,43]. Food facilities such as adequate markets and good connecting roads between villages are important for ensuring food availability and affordability in Jember Regency. The combination of high poverty rates and inadequate infrastructure will create complex conditions of food vulnerability and insecurity.

Other indicators such as the ratio of agricultural land area (9.6%) and the percentage of stunted toddlers (8.1%) are ranked as medium priorities. This is because both indicators have good potential and do not pose a threat to food security in Jember Regency. Land area reflects the potential availability of food [44–47], and stunting is the ultimate consequence of food utilization failure [23,30,48,49]. Both indicators in Jember Regency have good ratings. This is in line with the actual conditions, which show that the amount of agricultural land in Jember Regency is still extensive (fourth in East Java), and the stunting rate is also still relatively low in Jember. Meanwhile, other indicators such as access to electricity (weight 4%), clean water (5.2%), and the health worker ratio (3.9%) in Jember Regency are low priority indicators. This means that the achievement of these three indicators in Jember can be categorized as good, where access to electricity and clean water in Jember is already widespread, and the health worker ratio is also still balanced due to the large number of health facilities in each village that are more evenly distributed.

3.3 Comparison of Food Security Improvement Strategies in Jember Regency

Based on food security aspects and indicators, several food security improvement strategies can be designed, such as (a) the Jember Prosperous Family Card Program; (b) the Intensive Farming and Village Program; (c) One Village One Food Barn Movement, (d) Mobile Food Distribution in Outlying Villages, and (e) Family-Based Nutrition and Health Interventions. The results of the AHP analysis can be seen in Table 5.

Table 5. Priorities for Food Security Improvement Strategies in Jember Regency.

Category	Priority	Rank
Jember Family Welfare Card Program	37.9%	1
Intensive Farming and Village Program	4.3%	5
One Village, One Food Barn Movement	28.1%	2
Mobile Food Distribution in Outlying Villages	7.9%	4
Family-Based Nutrition & Health Intervention	21.8%	3
Consistency Ratio (CR)	0.034	

Source: Primary Data Processed (2025).

The results of the AHP analysis show that there is a high degree of consistency with the findings from the aspects and indicators. The Jember Family Welfare Card program is the top priority strategy with a weight of 37.9%. This program is logical because this cash social assistance strategy directly addresses the main challenges of affordability and the indicator of the number of poor people [50–54]. This program is considered highly effective and targeted at increasing the purchasing power of vulnerable groups, enabling them to access food and afford food prices. The second strategy that can be implemented is the One Village One Food Barn Movement (28.1%) and Family-Based Nutrition and Health Interventions (21.8%). Food barns can focus on food availability and stability at the community level. Food barns will also anticipate food affordability through local price control. Meanwhile, nutrition interventions specifically

address food utilization and stunting indicators. These two strategies will be a good combination to build food security in terms of supply and food quality for the community [42,55–58].

In addition, the mobile food program with a weight of 7.9% and the Intensive Farming and Village Program with a weight of 4.3% are programs with low priority. The mobile food program is considered an additional strategic solution that is short-term in nature, rather than a systemic strategy. Although the labor-intensive program touches on aspects of income and production, it is considered to have little direct impact [42,59]. Therefore, the resulting policy recommendation is to focus on a trilogy of strategies, namely: (a) social assistance to increase purchasing power, (b) community food reserves through food barns, and (c) specific nutrition interventions based on families or households.

4. Conclusions

The priority strategies that can be implemented by the Jember Regency Government to strengthen household food security are: (1) the Jember prosperous family card program, and (2) the One Village One Food Barn movement. The strategies are: (3) Family-Based Nutrition and Health Intervention, (4) Mobile Food Distribution in Outlying Villages, and (5) Intensive Farming and Village Program. The Jember Regency Government is advised to prioritize policy interventions in villages with low food security through a spatial and locally-based approach. In addition, the integration of cross-sectoral food security programs needs to be strengthened to support sustainable food development.

Abbreviations

Not applicable

Data availability statement

Data will be made available on request

CRediT authorship contribution statement

Ahmad Zainuddin: Conceptualization, Writing original draft and formal analysis. **Rena Yunita Rahman**: formal analysis, writing, review, and editing preparation, **Intan Kartika Setyawati**: Conceptualization ideas, data collection and analysis, reviewed the manuscript, **Illia Seldon Magfiroh**: data collection and analysis, reviewed literature, **Luh Putu Suciati**: Data curation and supervision, **Orawan Srisompun**: Investigation and Supervision, **Ahmad Syariful Jamil**: Investigation and Supervision, **Tiffany Rahma Abdillah**: Investigation and Supervision.

Declaration of Competing Interest

The authors of this manuscript declare no conflict of interest or competing interest

Declaration of Use of AI in the Writing Process

The author(s) used DeepL during the preparation of this manuscript to improve grammar.

After using the tool/service, the author(s) carefully reviewed and edited the content and take full responsibility for the content of the publication.

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