



Priority Strategy for Non-Rice Food Alternative "Millet": A Case Study from West Sulawesi, Indonesia

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Abstract. Millet (*Pennisetum glaucum*) is a strategic alternative non-rice food as a source of carbohydrates, which also has good health functions, such as being an antioxidant and containing bioactive compounds and fiber. For West Sulawesi residents, millet is substituted as a staple food to replace rice, which is currently processed into various traditional foods. This study was conducted in the Polewali Mandar Regency, West Sulawesi, Indonesia. The sample in this study consisted of 100 respondents, who were analyzed using the Quantitative Strategy Planning Matrix (QSPM). The results of the survey produced priority strategies that support the policy of developing potential non-rice food alternative "millet," namely (1) adequate farming equipment to make it easier for farmers to increase crop yields, (2) maximizing land potential by using efficient agricultural inputs, (3) making millet an essential local food in this region, (4) the government and stakeholders continue to support farmers to planting millet, (5) millet is managed sustainably with a focus on increasing income, as a local cultural entity, and environmentally friendly management, (6) training in the application of good agricultural practices and diversification of millet into home industry products, (7) building an adequate market network to facilitate sales and marketing, (8) accessible to capital by activating microfinance institutions in villages (strategy 4), (9) increasing the capacity of farmers and village stakeholders through institutional strengthening, counseling and training and (10) introducing millet more widely as an alternative food to replace rice which contains high levels of fiber and antioxidants.

Keywords: Food alternative, Millet, QSPM, West Sulawesi

1 Introduction

In a global context, millet can be encouraged as a food alternative to realize global zero hunger, even though this food product has not yet received serious attention from stakeholders. Millet is globally known as foxtail millet, a non-rice food crop that can easily adapt to tropical and subtropical climates; therefore, so it has the potential to be developed in Asian countries, Indonesia, China, and India, as well as North Africa and America [1]. Millet (*Pennisetum glaucum*) is a food commodity with potential to be

developed to strengthen food security as a source of carbohydrates to replace rice. This plant grows in various regions of Indonesia, including West Sulawesi. The millet planting areas in the South Sulawesi region are Enrekang, Sidrap, and Maros, whereas in the West Sulawesi region, they are Polewali Mandar and Majene. Millet has advantages over other carbohydrate plants: it can grow in almost all types of soil, is dry and less fertile, easy to cultivate, has a short plant life, and has various uses [2].

In general, people do not yet know that millet is a food source or processed ingredient that can support food security and help them anticipate hunger problems [3]. Pearl millet, also called millet, ranks sixth as the most essential grain consumed by one-third of the world's population. Millets grow well in areas with high temperatures and limited water availability, without applying fertilizer or other technological inputs, and on critical land where it is challenging to plant other grains, such as maize, wheat, and sorghum [4], [5].

West Sulawesi is a potential area for the development of millet, even though millet is registered with the Ministry of Agriculture as a local food source, specifically in the Polewali Mandar Regency. Various problems faced in the development of millet include the low application of technology, limited farming capital, fluctuations in production and prices, and limited market access for selling millet. As a result, millet productivity remains relatively low.

This research aims to determine priority strategies for developing potential non-rice food "millet" in West Sulawesi, especially in the Polewali Mandar Regency. Therefore, a Quantitative Strategy Planning Matrix (QSPM) analysis is used to rank the priority scale. This strategy is appropriate for increasing business productivity and economic growth. Therefore, as a local food source, millet has the potential to generate income for farmers, thus requiring a strategy to achieve this goal.

2 Methods

This study was conducted in the Polewali Mandar Regency, West Sulawesi Province. The location was determined deliberately (purposive sampling), considering that Polewali Mandar, this region, produces more millet than other regions in West Sulawesi Province. The sample in this study comprised 100 farmers who run millet farming businesses, with up to 100 people meeting the requirements of a representative sample and the minimum value for large samples [6]. Primary data were collected through interviews with farmers and related agencies, supported by secondary data from sources relevant to this research theme.

Quantitative strategic planning matrix (QSPM) analysis is a strategic management approach for evaluating various possible strategies and comparing several feasible actions. There is no limit to the strategy that can be assessed or the number of strategies that can be observed simultaneously when using the QSPM [7].

The top row of the QSPM contains the alternative strategies obtained from the SWOT matrix. Conceptually, the QSPM determines the relative attractiveness of various strategies based on important external and internal success factors. The relative

attractiveness of each strategy within a set of alternatives was calculated by determining the cumulative impact of each critical external and internal success factor. Any number of alternative strategy sets can be included in the QSPM and any number of strategies can be included in each set. However, only the strategies in a particular set are evaluated relative to each other [7]. The following are the stages of QSPM development:

1. The external (opportunities and threats) and internal (strengths and weaknesses) factors are listed in the left-hand column of the QSPM. This information was directly obtained from the EFE and IFE matrices.
2. Assigned weight to each external and internal key success factor. These weights were the same as those in the EFE and IFE matrices. The weights are placed in a straight column to the right of the external and internal success factors.
3. Examine the matrices in stage 2 and identify alternative strategies that the company must consider. Note the strategy at the top of the QSPM row:
4. The attractiveness score (AS), which is a value that shows the relative attractiveness of each selected strategy AS, was determined by examining each external and internal success factor. The role of each factor in the strategy selection process is determined. The US value limits are 1) not acceptable, 2) possibly acceptable, 3) probably acceptable, 4) exciting, and 5) not relevant.
5. The total attractiveness score (TAS) was then calculated. The TAS is obtained by multiplying the weight (stage 2) by the AS (stage 4) in each row. TAS shows the relative attractiveness of each alternative strategy.
6. The total attractiveness score is then calculated. All the TAS were added to each column of the QSPM matrix. Of the several TAS values obtained, the TAS value of the alternative strategy was the highest, indicating that the alternative approach was the leading choice. The lowest TAS value suggests that this alternative strategy was the last choice.

3 Results and Discussion

3.1. Overview of Alternative Food "Millet" in West Sulawesi

The use of millet as a food product in Indonesia is not as widespread as it is abroad. In reality, Indonesia, which is still dependent on rice imports, can encourage millet as an alternative food to replace rice because this commodity has excellent potential as a source of carbohydrates, antioxidants, bioactive compounds, and fiber which are essential for health [8] even millet is a non-rice commodity that contains carbohydrates and protein that are not inferior to rice and millet calcium is also superior to the calcium in maize [8]. Millet is also rich in vitamins B and A, calcium, iron, zinc, potassium, phosphorus, magnesium, copper, and manganese [9].

The general public is not yet familiar with barley as a food source; therefore, it has often been used as bird food. The community can process this plant as a food source to support food security and anticipate hunger problems [10]. Millet ranks sixth as the most important grain and is consumed by one-third of the world's population.

Polewali Mandar, as one of the regions in West Sulawesi, is one of the potential areas for the development of millet, as millet is registered in the Ministry of Agriculture as a local food originating from Polewali Mandar. Therefore, millet is an important food that can be cultivated and processed into industrial food products. Millet used as a food source generally has an attractive color, such as a yellowish color, and a sharp flavor. Data from the Polman Regency Agriculture and Livestock Service, 2016 shows that the potential for millet land reaches thousands of hectares with a production volume of 1.5 tons per hectare, even though millet has 14 pairs of chromosomes with potential yields. It can reach 3.5 tons per ha [11].



Fig 1. Millet plantation and local farmers in West Sulawesi, Indonesia

The people of West Sulawesi in several regions, including Polewali, have been familiar with consuming millet since immemorial and have passed down from their ancestors. Even though millet in West Sulawesi is planted only if it cannot use the land to produce corn, it is used as a staple food to replace rice, and millet is often processed into traditional regional foods, such as porridge, as well as several other conventionally processed foods. Millet is processed into couscous, flatbread, dough, porridge, non-alcoholic drinks, and beer [12]. The millet has become an alternative domestic food associated with the local Mandar culture in West Sulawesi [13]. Apart from being a source of food, barley is a symbol of various vital ceremonies, such as religious celebrations, weddings, births, and babies. Millet seeds in Polewali Mandar are processed into multiple local snacks to complete the menus of various cultural parties [14].



Fig 2. Traditional local Mandar cake from millet flour

3.2. Priority strategies for non-rice alternative food "millet"

QSPM is an analytical tool used to determine priority strategies to be implemented. After SWOT analysis has formulated strategies based on the key factors in the IFE and EFE matrices, the next step is to determine the priority strategies that can be implemented to increase production in millet farming, both in quantity and quality.

Based on the results obtained, 10 strategic priorities were ranked in order of importance based on the total attractive score (TAS) value that can be implemented in alternative food "millet" in West Sulawesi (Table 1). The higher the TAS value, the higher the priority is to run. The TAS value is obtained by multiplying the weight of the SWOT calculation results by the Attractive Score (AS) value, where the AS value is obtained by calculating the average value of the internal factors (strengths and weaknesses) and external factors (opportunities and threats).

Based on the TAS value for strategic priorities for potential non-rice food alternatives, "millet," the main priority is procuring farming equipment to increase millet productivity. This is a top priority because farmers use only simple equipment and land management is still conventional. In addition, millet is planted only if the land is not appropriate for planting maize because of the dry season when the water supply is restricted. The low application of technology still limits millet farming, so productivity has not become the focus of farmers. Farmers in West Sulawesi plant millet use simple equipment without any technology or sophisticated equipment for tilling the land and during harvest [14], [15]. The tool used during harvest is Ani-ani, a traditional rice harvesting tool shaped like a small knife attached to a piece of wood or bamboo. The millet is cut individually using this tool, so the process takes a long time.

Priority correlates with second priority, so it can be said that these two factors are needed to maximize the potential of millet as a food alternative. The second priority strategy is maximizing land potential through the efficient use of agricultural inputs, where farmers in West Sulawesi have a limited land area [11].

Especially at the research location, millet is only planted if climatic conditions or water are limited, and millet is very friendly to climate change. Therefore, to maximize the potential of millet, it is necessary to use inputs such as seeds, fertilizers, and

equipment to make it easier for farmers in the millet farming process. To help farmers, it is necessary to provide informative germplasm through a characterization process [16].

Table 1. Non-rice potential food priority strategies of millet

Sequence	Priority strategies	AS	TAS
1	Adequate farming equipment to make it easier for farmers to increase crop yields (strategy 6)	3.27	6.112
2	maximizing land potential by using efficient agricultural inputs (strategy 3)	3.11	5.79
3	Making millet an essential local food in West Sulawesi (strategy 1)	3.05	5.36
4	The government and stakeholders continue to support farmers in planting millet (strategy 10)	3.11	5.17
5	Millet is managed sustainably with a focus on increasing income, as a local cultural entity, and environmentally friendly management (strategy 9)	2.77	5.03
6	Training in the application of good agricultural practices and diversification of millet into home industry products (strategy 8)	2.78	4.61
7	Building an adequate market network to facilitate sales and marketing (strategy 2)	2.44	4.49
8	Accessible to capital by activating microfinance institutions in villages (strategy 4)	2.22	4.14
9	Increasing the capacity of farmers and village stakeholders through institutional strengthening, counseling, and training (strategy 5)	2.11	4.59
10	Introducing millet more widely as an alternative food to replace rice, which contains high levels of fiber and antioxidants (strategy 7)	2.00	2.81

The millet in West Sulawesi is not a main priority for the government and NGOs, so farmers who plant millet are not a priority crop, even though millet has the same potential and uses as other types of food. In contrast, millet has outstanding functions in a healthy body. For people of West Sulawesi, millet is often used as a substitute for rice. The rest are prepared in various forms of local snacks and are frequently used to complement religious events or traditional parties [16].

As mentioned in the fourth priority, millet needs to be farmed within the concept of sustainable agriculture to become a source of the community economy, be maintained as a local cultural entity, and avoid using chemicals in the farming process. Millet differs from other food crops; this plant does not require intensive care and takes 3-4

months to produce, which can produce 3.5 tons/ha if managed under optimal conditions [16]. However, millet is favored by bird pests, which often eat millet seeds before they are harvested.

The fifth priority requires training related to applying good agricultural practices (GAP) and the diversification of millet into home industry products. In West Sulawesi, especially at the research location, farmers have never been given training related to GAP, even though in reality, farmers already have unstructured skills, and the habit has passed down from their ancestors to grow millet. GAP standardized agricultural products could ensure food safety for consumers [17]. Meanwhile, for millet diversification, only one home industry processes millet flour into cakes, namely, a cake whose ingredients are the result of mixing millet flour, palm sugar, and coconut milk. Therefore, in the future, it is necessary to support the home millet processing industry so that the village economy can improve and farming families can prosper. Food diversification is one of the government's efforts to reduce inequality in socioeconomics through development programs for sustainable food security concepts [18].

Building an adequate market network is also a priority strategy to support and facilitate the sale of millet so that millet, which has only been sold in traditional and local markets in West Sulawesi, and can reach potential market networks outside the region. Millet is mainly used for industrial needs abroad but has not been examined in Indonesia. Therefore, millet can become a raw material for industry, especially for food and beverages. Millets can be a great variety of foods, such as porridges, flatbreads, steamed and rice products, snacks, condiments, and drinks, including beer and distilled spirits, after mixing with microbial fermentation [19].

Another strategy is needed to provide easy access to capital by activating village microfinance institutions. Farmers with small land ownership status and whose business scale is still relatively small find it challenging to increase their business scale and income, because there are no microfinance institutions capable of supplying capital to farmers. Banking only accommodates large-scale agricultural businesses with significant land ownership, whereas farmers need small capital to increase the scale of their farming businesses. The land planted with millet in West Sulawesi is still on a small scale, namely under 0.5 hectares. In addition, microfinance was the leading supplier of agricultural finance, and most microfinance institutions only funded agricultural activities with lower risks, such as agricultural trade and food processing. In this case, microfinance is less able to meet most farmers' financing needs [20], [21].

Apart from capital, the capacity of farmers and village stakeholders also needs to be increased through institutional strengthening, counseling, and training. Through farmer institutions, such as farmer groups, training programs can be provided to improve millet farming. In addition, the activity of agricultural extension workers can become an interrelated node to mobilize organizations and become facilitators to increase farmers' capacity and knowledge. The agricultural extension designed by the central government encourages the local government to increase the farmers' participation in sustainable agribusiness [21]. Millet is not a food that is widely known by the public, unlike rice, even though its function and benefits can surpass those of rice from a health

perspective. Therefore, a strategy to introduce barley more widely as an alternative food to replace rice, which contains high levels of fiber and antioxidants, is also vital [22].

4. Conclusion

Quantitative Strategy Matrix Planning (QSPM) with the highest TAS value of 6.112 is the strategy for procuring farming equipment to make it easier to increase productivity, while the lowest TAS value is 2.809; namely, the strategy of introducing millet to the market and consumers as a local food that is rich in fiber and contains antioxidants.

Acknowledgments. The authors gratefully acknowledge Indonesia's Ministry of Research, Technology and Higher Education for their financial support. I am also thankful to the LPPM Universitas Sulawesi Barat.

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