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Assessing Feasibility and Sustainability against Corn Commodities in Muna Areas, Southeast Sulawesi, Indonesia: A Comprehensive Analysis

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ABSTRACT

Background: Muna area has the potential for corn production. This study aims to analyze the feasibility and sustainability of corn commodities in the Muna area.

Methods: Data obtained by focus group discussion with the World Café format. Through multidimensional scaling, data analysis was performed by the multi-criteria decision-making and the modified rapid appraisal for fisheries ordinance technique in RAP_CROPS.

Result: The feasibility analysis shows that the corn commodity fulfills the following criteria: (i) A primary commodity in the Muna area; (ii) Suitable land for corn development; (iii) Feasible financial; (iv) Socio-culturally feasible, (v) policy support. The results showed that the economic and institutional dimensions have enough sustainable status, the ecological size has a continuous category and the technological and socio-cultural dimensions have less sustainable.

Key words: Agriculture development, Community culture, Institutional dimensions, Multidimensional scaling, Policy support.

INTRODUCTION

Agricultural development holds paramount importance in Indonesia as an essential sector. The country is blessed with abundant natural resources and possesses a comparative advantage in the agricultural industry. With vast fertile lands, favorable climate conditions and a diverse range of crops, Indonesia has the potential to thrive in agricultural production. Its strategic geographic location also provides easy access to markets, further enhancing its competitive edge. These advantages are fundamental for economic growth, therefore, they need to be managed well (Nainggolan and Aritonang, 2012). The agricultural sector in each region has different types of primary commodities. These are determined based on the potential of natural resources and human resources. Besides, the determination of major commodities also considers land suitability, the contribution of a commodity to economic growth and region development (Cipta *et al*., 2017).

Agricultural development in the Muna area consists of seven of these commodities. They are paddy, maize, cassava, soybeans, green beans and peanuts. However, all these commodities are managed by the community. Corn commodity is a food plant and continues to grow. The development of corn commodities concerned with strengthening food self-sufficiency, increasing production, increasing exports and encouraging employment opportunities is based on the Muna Regional Development Program in 2016-2021. The development of corn commodities is supported by the potential of vast land and community culture.

Land potential for corn production is spread in all rural Muna areas. It has around 55,885 hectares, but only 6,348 hectares are utilized, with 4.7 tons/hectare of productivity (Dinas, 2015). Therefore, the Muna area still has 49,537 hectares for corn production. The Muna government has the initiative to use 6,384 ha of hybrid corn production in 2020. Therefore, a total area of 12,000 hectares is used with a production target of around seven tons/hectare. The development of major commodities is a critical strategy to develop rural areas (Cipta *et al*., 2017), triggering the competitiveness of the rural economy and increasing trade between rural areas and regions. Besides, the development of commodities increases people's income and contributes to increasing regional income (Rustiadi *et al*., 2017). In the present study, we evaluate the feasibility and sustainability of corn development as a significant commodity in the Muna area.

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MATERIALS AND METHODS

Study design

This research was conducted from June to October 2018 in the Muna area, Southeast Sulawesi. The Muna area was selected purposively due to 90% of the total area being an agricultural development area. This study used a quantitative and descriptive research approach, besides, to explain the various relationships in all data.

Methods

This research, therefore, used primary data and secondary data. Primary data was obtained by focus group discussion (FGD) with World Café format. The FGD method effectively gains information, dialog, advice and opinions to discuss complex issues. Erlinda (2016) stated that World Café techniques rely on collaborative dialog and the importance of participants during dialog. Furthermore, World Café is a flexible and adaptive approach that can be used in a variety of FGDs (The World Café Community Foundation, 2015). Secondary data was obtained through searching data and literature at various agencies such as the Department of Agriculture and Food Security, the Office of Plantations, the Service of Animal Husbandry, the Service of Fisheries and Maritime Affairs, the Office of Industry and Trade, the Office of Cooperatives, Small and Medium Enterprises, the Central Bureau of Statistics and Regional Development Planning Agency related to this research. The FGD on the World Café format can be seen in Table 1.

There were 45 participants, including government representatives (Bappeda, the Maritime and Fisheries Office, the Agriculture Office, the Industry and Trade Office and the Cooperative Office and Small and Medium-sized Enterprises), representatives from academics, NGOs, the private sector and other stakeholders.

Data analysis

Analysis of the feasibility of developing corn was conducted by Multi-Criteria Decision Making (MCDM). The decision to determine the viability of a sustainable business must use multiple criteria, not a single criterion. When using a single criterion and without considering other criteria, the business will face many obstacles (Marimin and Maghfiroh, 2010). Several criteria can, therefore, be used to create a major sustainable commodity as follows:

- The determination of base commodity is performed by the Location Quotient (LQ) approach (Hood, 1998).
- Land suitability is analyzed through land-use requirements for corn, according to the study by Djaenuddin *et al.* (2000).
- Financial and economic feasibility are analyzed through a financial analysis approach with benefit-cost ratio analysis (Soekartawi, 2003) and an economic approach through demand analysis (Bambang, 2009).
- Socio-cultural dimensions are analyzed descriptively.
- Government policies are analyzed through the review of regulations.

An explanation of each of these criteria can be presented in Table 2.

Analysis of the sustainability of corn commodity was done using the rapid appraisal for fisheries approach. It is also modified by RAP_CROPS through the multi-dimensional scaling (MDS) approach (Pitcher and Preikshot, 2001). The analysis of sustainability in corn commodity development is performed by several stages, as follows:

- Determination of the sustainability dimension and consisting of ecological, economic, socio-cultural, technological and institutional dimensions.
- Attributes on each dimension of sustainability. Each attribute can be scored on an ordinal scale according to the sustainability criteria of each dimension.
- RAP_CROPS ordination analysis using the MDS method. It is performed by the SPSS program.
- Assessing the index and status of sustainability in each dimension.
- Leverage analysis to determine variables that affect sustainability.

All data was analyzed through MDS to determine the point that reflects the sustainability of corn commodities toward the good point and the bad point. The score of each attribute forms a matrix X (n × p), where n is the number of dimensions along with the point of reference and p is the number of attributes used. Then, scores were standardized for each attribute. Therefore, each attribute has a uniform weight, and the difference between measurement scales can be omitted, with the standardization method, as follows:

$$X_{ik}sd = \frac{X_{ik} - X_k}{S_k} \quad \ldots(1)$$

Note:

- $X_{ik}sd$ = Standard score for the dimension (Including its reference point) to $_i$ = 1.2 … n for each attribute to k.
- X_{ik} = Initial score of dimension (Including its reference point) to $_i$ = 1,2 … n, for each attribute to $_k$ = 1,2 … p.
- X_k = Median score on each attribute to $_k$ = 1,2…p.
- S_k = Standard deviation of scores at each to $_k$ = 1,2,…p.

Goodness fit in MDS is presented by the S-stress and R2 (Malhotra, 2018). A good model is shown with an S-stress value smaller than 0.25 or S <0.25 and R2 close to 1. The system sustainability index scale has an interval of 0%-100%. In the present study, there are four categories of sustainability, as shown in Table 3.

Goodness fit in MDS is presented by S-stress and R2 (Malhotra, 2018). A good model is indicated by an S-stress value of less than 0.25 or S <0.25, meaning that the error rate in data measurement cannot be more than 25% and R2 is close to 1, meaning that the contribution of each indicator will be better.

RESULTS AND DISCUSSION

Feasibility of corn commodity development

Corn has the highest value as the primary commodity in Muna area based on the results of the MCDM analysis. This

analysis uses essential commodities, land suitability, economic and financial feasibility, socio-cultural feasibility and national and regional policies. The determination of corn as a major commodity was a result of fulfilling all criteria in Table 3, as follows:

- Corn as a base commodity 6,348 hectares used for the development of corn commodities and spread in the Muna area.
- The development of corn has potential land suitability. The Muna area has a flat topography and fertile land based on agroecology.
- Fulfilling economic viability.
- The development of corn farming does not require large costs to reach maximum production.
- Fulfilling the socio-cultural feasibility. Corn is a major food in the Muna area.

Table 1: FGD description of world café format for corn commodity in Muna area.

Question	Formation	Participant	Output
Café 1			
What is the scenario achieved in the development of corn commodity	Turn over every 30 minutes at each café.	Government, NGOs, Academics, Private and Community.	Agreement on the development of corn commodity and indicators used as a benchmark.
Café 2			
Indicators/attributes in the planning of leading commodity development	Topic discussions by a facilitator.	Each participant chooses a topic at the café randomly in each turnover.	The deal is determined by five times a turnover.
Café 3			
What are the appropriate measurements for the indicators of corn commodity	At the end of the turnover, a discussion is held to gain agreed indicators.		

Table 2: Commodity aspect and criteria.

Criteria	Score	Noted
Base commodities	3	LQ >1: widely spread in Muna area (>50%)
	2	LQ = 1: widely spread in Muna area (50%)
	1	LQ <1: widely spread in Muna area (<50%)
Land suitability	3	Very suitable
	2	Quite appropriate
	1	Not suitable and requires a lot of treatment
Financial feasibility	3	Prices are reasonable and high demand in the market
	2	Low prices and high demand in the market
	1	Low prices and low demand in the market
Socio-cultural aspects	3	It has long been performed by the community and developed by >50% of the Muna area
	2	It has long been performed by the community and developed by <50% of the Muna area
	1	It is new by the community and developed by <50% of the Muna area
Government policy	3	Targeted by central and local governments
	2	Targeted by local governments
	1	Not targeted by central and local governments

Table 3: Index value and sustainability status of corn commodity.

Index value	Status	Category
0.00-25.00	Not sustainable	Bad
25.01-50.00	Less sustainable	Not good
50.01-75.00	Sustainable	Good
75.01-100.00	Strongly sustainable	Very good

- Supporting the policies of the central, provincial and regional governments. The government program is in strengthening the food security system and corn as a product for raw food and the food industry.

The data obtained show that the corn commodity fulfills all the eligibility criteria. Following Hood (1998), opinion that the dominance of a commodity in a particular region affects economic growth, a base commodity is fulfilled by more than 50% of the total area in the Muna area. In terms of land suitability, corn commodities in the Muna area are very feasibly developed because of the existence of land fertility and relatively flat topography, with Djaenuddin *et al*. (2000) stating that corn production increases on fertile land with a relatively flat topography.

Sustainability index development of corn commodity in the muna area

Social and technological aspects are categorized as less sustainable (Fig 1).

Fig 1 illustrates the sustainability index for maize development in Muna area. Social and technological dimensions have index values of 48.21% and 38.44%, respectively, categorized as less sustainable. Meanwhile, the economic and institutional dimensions are fully sustainable, with indexes of 67.35% and 50.35%, respectively. Ecological dimensions have an index of 75.33%, indicating sustainability. To enhance the sustainable development of the superior corn commodity, key attributes include ecological factors such as climatic conditions, seed availability and quality; economic contributions, benefits, and feasibility; social empowerment, community involvement and education; technological support and infrastructure; and institutional improvements.

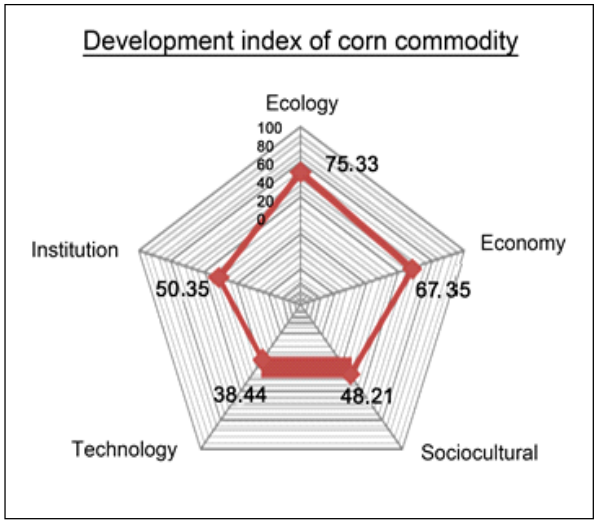


Fig 1: Analysis of index and sustainability of corn commodity development.

The "S-stress" of each dimension has a smaller value than the specified (<0.25) value. The value <0.25 is better than >0.25. While the determination coefficient R2 in each dimension is quite high, being close to 1 (Table 4). Thus, both of these statistical parameters indicate good sustainability against the corn commodities development system.

Feasibility of corn commodity development in muna area

Furthermore, in terms of financial feasibility, corn development does not require a large number of production costs, and therefore it has the potential to increase profits for farmers. Low production costs are critical in a business (Soekartawi, 2003) and corn is very feasibly developed in the Muna area because of the high market demand, which impacts business sustainability in the future (Bambang, 2009).

According to the socio-cultural aspect, the development of corn in the Muna area is feasibly developed due to the support of the local community. This is in line with Nikoyan *et al.* (2018) that business development occurs with the contribution of the local community. Furthermore, in terms of government policy, corn commodity in the Muna area is supported by the central and regional government policies. It is in line with Nikoyan's opinion that corn development is a priority program from the Ministry of Agriculture program, Republic of Indonesia. It is a part of the Agricultural Strategy Command Program (KOSTRATANI), while the local government policies in the Muna area have been present in the Regional Medium-Term Program in 2016-2021.

Sustainability analysis of corn commodity based on the ecological aspect

The ecological aspect is related to the development of corn commodities. There is a 73.33% sustainability index in the Muna area and the Muna area is categorized as a sustainable category. These conditions indicate that the development of corn commodities has been done with attention to ecological aspects. However, three attributes or sensitive leverage affect the sustainability of major commodities, as shown in Fig 2.

Fig 2 indicates that seed quality, climatic conditions, and corn seed availability influence sustainability in developing superior corn commodities in the Muna area. The limited consideration of seed quality and availability, particularly with local varieties, contributes to reduced sustainability, leading to implications of lower productivity.

Ecology is a parameter to develop corn commodities. Ecological compatibility determines the success or failure of a farm. In general, business development is only based on economic aspects and profits and these aspects are

Table 4: Statistical parameters (Goodness of fit) from index analysis and sustainability status of corn commodity development.

Statistic parameter	Ecology	Economic	Socio-cultural aspects	Technology	Institutional
S-stress	0.112	0.136	0.131	0.223	0.154
R2	0.887	0.801	0.811	0.621	0.804

considered more critical than the ecological aspect. Therefore, several businesses fail. The ecological aspect has an important role in business development and should be considered due to its effects on a sustainable economy in the future (Rustiadi *et al.*, 2017; Fauzi, 2006; Mulyani and Agus, 2017).

The quality of seedlings, the climate conditions, and the availability of corn seeds determine the sustainability of corn commodities in the Muna area, with the low quality and availability of corn seeds affecting the sustainability of corn commodities. These conditions have implications for productivity (Fig 2). The low productivity of corn commodities occurs due to the low quality of seedlings and climate conditions (Rahni, 2011). Besides, corn production increases due to the quality of seeds, especially in the use of hybrid variety seeds, meaning that a hybrid variety of seeds should be used to increase productivity (Sari *et al.*, 2017). Hybrid variety seeds increase productivity by 15% compared to local varieties (Setimela *et al.*, 2006).

Sustainability analysis of corn commodity based on economic aspect

There are three attributes of economic aspects that affect the sustainable development of corn commodities. They contribute to original local government revenue, profits from primary commodities and feasibility of the commodity (Table 5).

The economic aspect is the most sensitive and considered in developing any business. A good business provides many profits and a business decision provides significant benefits. Corn commodity in the Muna area is still being developed because it provides profitable income for farmers. The economic aspect of the sustainability index is 67.35%, which indicates that the development of corn commodities is quite sustainable (Fig 3).

The data in Fig 3 shows that there are three attributes of leverage sensitive to the economic dimension that influence the sustainability of the development of superior corn commodities, namely: (i) contribution to PAD, (ii) profits from superior commodities and (iii) feasibility of farming low superior commodities. The low profits are derived from corn farming. They affect the low tax by local governments as original local government revenue. Due to conventional farming systems, a low source of regional revenue occurs (Edgerton, 2009). The development of corn commodities is sustainable and contributes to regional revenues; therefore, it is necessary to perform an intensive market-orientated and commercial cultivation system (Budiman, 2013).

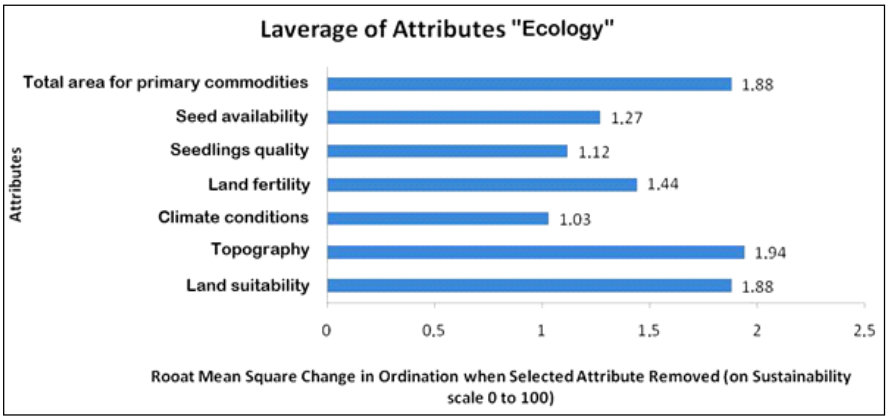


Fig 2: Leverage attributes in the sustainability of corn commodity based on ecological aspects.

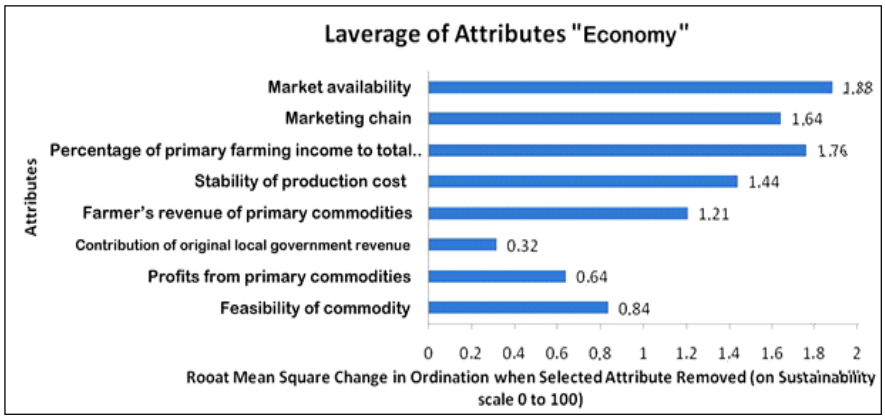


Fig 3: Leverage attributes in the sustainability of corn commodity based on the economic aspect.

Sustainability analysis of corn commodity based on the socio-cultural aspect

The analysis of sustainability in the socio-cultural aspect is classified as less sustainable with an index value of 48.21% (Fig 4). Several leverages affect the low socio-cultural aspect of corn commodity development, including the lower role of workers, low empowerment of farmers, low family participation and collaboration between farmers and market partners. These aspects need to be considered. Community empowerment improves the capabilities of farmers in developing corn commodities.

The socio-cultural sustainability analysis for superior corn commodity development in Muna area shows an index of 48.21%, categorizing it as less sustainable. Factors influencing this include (1) limited role of extension workers, (2) modest farmer empowerment, (3) cooperation systems with market partners and (4) reduced family participation. Addressing these four attributes is crucial for the sustainable development of superior corn commodities. The socio-cultural dimension is an important factor and influences individual decisions in the development of corn commodities. Rural communities only develop agricultural commodities. These rural communities are associated with agricultural life. In the main, the development of corn commodity is performed by increasing community empowerment and community participation in the Muna area. Besides, the role of the instructor is also a vital factor (Theresia and Toto, 2014; Pinto, 2015; Yuwono, 2016).

Sustainability analysis of corn commodity based on technological aspect

In a present study, the sustainability of technology development in corn commodities is less sustainable, or the index value is 38.44%. This condition shows that supporting technology is very low related to the development of corn commodity, both from the cultivation system, land management, eradication of pests and diseases. The processing industry is urgently needed by supporting farmers with technology, facilities and infrastructure (Fig 5).

The analysis reveals a technology sustainability index of 38.44% for corn commodity development in the Muna area, indicating lower sustainability. Shortcomings encompass cultivation practices, land management, pest control, disease prevention and post-harvest handling. Noteworthy factors influencing corn commodity development include lacking support for diversified industries, limited technology adoption among farmers and inadequate farming facilities and infrastructure provision. Addressing these technological challenges is vital for fostering successful corn commodity growth, especially in the context of agricultural business development. The skilled workforce transition from agriculture observed in the Muna area mirrors broader concerns within the farming sector (Priyarsono and

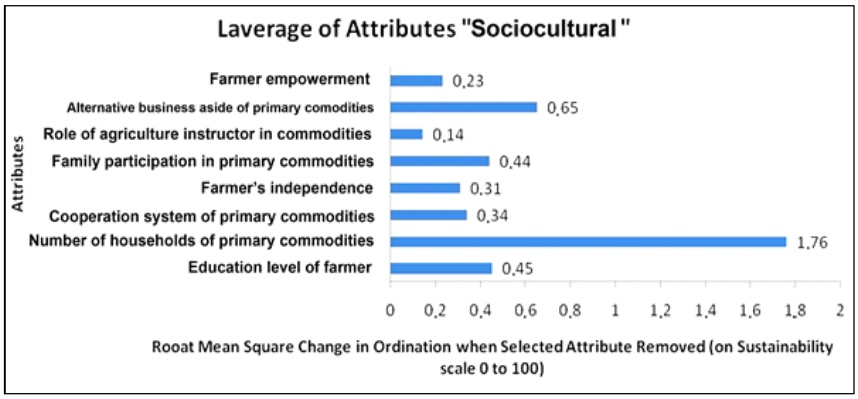


Fig 4: Leverage attributes the in sustainability of corn commodity development based the on socio-cultural aspect.

Table 5: Food crop commodities based on multi-criteria decision making (MCDM).

Type of commodities	Majority aspect					
	Base commodities	Land sustainable	Economic	Socio -cultural	National and regional policies	Total score
Paddy yield	1	2	3	1	3	10
Paddy	1	3	3	3	1	11
Corn	3	3	3	3	3	15
Cassava	3	2	1	2	1	9
Peanuts	1	3	3	3	1	11
Soybeans	1	2	3	1	3	10
Green beans	1	2	1	1	1	6

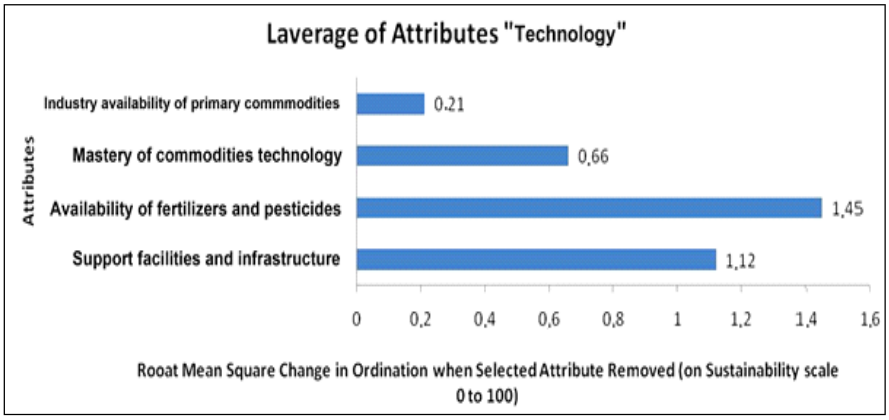


Fig 5: Leverage attributes influence the sustainability of corn commodity development based on the technology aspect.

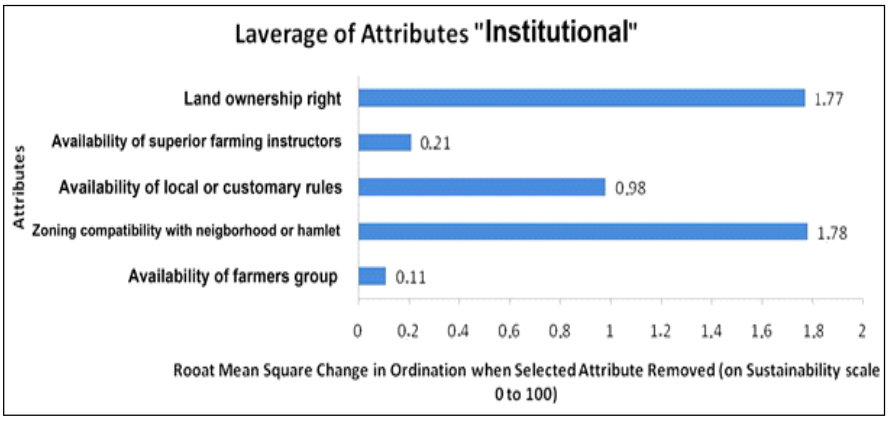


Fig 6: Leverage attributes in the sustainability of corn commodity development based other institutional aspect.

Backe, 2007). The processing industry is urgently needed by supporting farmers with technology, facilities and infrastructure (Fig 5). The availability of the agricultural industry impacts the community. Besides, it also affects developing agricultural products as industrial raw materials. Therefore, there is a relationship between farmers and agricultural entrepreneurs' sectors (Priyarsono and Backe, 2007).

Sustainability analysis of corn commodity development based on the institutional aspect

The institutional dimension is the most critical attribute in the development of corn commodities. An excellent institutional system encourages cheap production costs. An institutional system fosters togetherness and unity based on the principles of trust, norms and networking between the farmers (Nikoyan *et al*., 2018). The index value of the institutional aspects is 50.35%, which shows that the development of corn commodities in the Muna area is quite sustainable (Fig 6).

According to the sustainability analysis results, the institutional dimension index value is 50.35%. This shows that the development of the superior commodity of corn in Muna area is entirely sustainable. The institutional aspects that influence the development of corn commodities are the lower role of farmer groups, unskilled workers and local wisdom and these aspects need attention to develop corn commodities in the Muna area.

The institutional dimension is the most critical attribute in the development of corn commodities. An excellent institutional system encourages cheap production costs. An institutional system fosters togetherness and unity based on the principles of trust, norms and networking between the farmers (Nikoyan *et al*., 2018). The farmer groups, the role of institutions and the availability of agricultural instructors play an important role in farm productivity and product market information. These strategies can reduce production costs and increase incomes for the farmer (Hermanto, 2007).

CONCLUSION

The feasibility analysis underscores corn's prominence as the primary commodity in the Muna area, supported by a substantial cultivation area of 6,348 hectares, favorable agroecological conditions, economic viability and solid socio-cultural acceptance. This determination aligns with regional policies and government initiatives focused on food security and industry support. The sustainability evaluation reveals a robust foundation for corn commodity development, with

notable strengths in economic and institutional dimensions, while ecological aspects also contribute favorably. Strategic enhancements are recommended, including improving ecological factors, fostering financial contributions and optimizing institutional roles, to ensure the enduring viability of the superior corn commodity.

The feasibility and sustainability of superior corn commodity development in the Muna area are evident, supported by fertile land, cost-effectiveness, market demand, community backing and favorable policies. While ecological aspects exhibit sustainability, economic and institutional dimensions rank moderately. However, addressing technological and socio-cultural factors is essential for enhanced sustainability. Further research is recommended to refine the development, including creating models for corn farmer empowerment and institutional strengthening and exploring intercropping possibilities with other crops to ensure long-term viability.

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Author contributions

Anas nikoyan Conceptualization, Methodology, Writing-Original draft preparation. La Ode Alwi: Data curation, Writing-Original draft preparation. Nini Mila Rahni: Visualization, Investigation, Writing- Reviewing and Editing.

Conflict of interest

The authors declare no competing interest.

REFERENCES

Bambang, J. (2009). Economic and Business Research Methodology. Bogor, Indonesia: IPB Press.

Budiman, H. (2013). Success in Growing Corn, a Promising Agricultural Commodity. Yogyakarta, Indonesia: Pustaka Baru Press.

Cipta, S.W., Sitorus, S.R.P. and Lubis, D. (2017). Development of superior commodities in the Tumpang development area, Malang Regency. Jurnal Kawistara. 7(2): 115-206.

Dinas, P.S.T. (2015). Program to increase rice, corn and soybean production. Kendari, Indonesia: Dinas Pertanian Sulawesi Tenggara.

Djaenuddin, D., Marwan, H., Subagyo, H., Mulyani, A. and Suharta, N. (2000). Land suitability criteria for agricultural commodities. Bogor, Indonesia: Pusat Penelitian Tanah dan Agroklimat.

Edgerton, M.D. (2009). Increasing crop productivity to meet global needs for feed, food and fuel. Plant Physiology. 149: 7-13.

Erlinda, N. (2016). Sustainable regional development policy in jambi province using FLAG approach. Jurnal Ekonomi Dan Kebijakan Publik. 7(1): 1-14.

Fauzi, A. (2006). Economics of natural resources and the environment: Theory and application. Jakarta, Indonesia: Penerbit PT Gramedia Pustaka Utama.

Hermanto, R. (2007). Agricultural institutional design in the implementation of prima tani in South Sumatra. Analisis Kebijakan Pertanian. 5(2): 110-125.

Hood, R. (1998). Economic Analysis: A Location Quotient. Primer: Principal Sun Region Associates, Inc.

Malhotra, N.K. (2018). Marketing Research: An Applied Orientation. 7th Ed. London, UK: Pearson.

Marimin, N. and Maghfiroh. (2010). Application of Decision-making Techniques in Supply Chain Management. Bogor, Indonesia: IPB Press.

Mulyani, A. and Agus, F. (2017). The need and availability of reserved arable land realize Indonesia as the world food supplier in 2045, English summary. Analisis Kebijakan Pertanian. 15(1): 1-17.

Nainggolan, H.L. and Aritonang, J. (2012). Development of Agribusiness Systems in the Context of Sustainable Agricultural Development. In: National Conference of Pertanian Presisi Menuju Pertanian Berkelanjutan. Medan, Indonesia, 3 April 2012, BKS-PTN Wilayah Barat Bidang Ilmu-Ilmu Pertanian. pp: 1-11.

Nikoyan, A., Alwi, L.O. and Rahni, N.M. (2018). The strategy of accelerating the development of superior products in Muna regency. Kendari, Indonesia: University of Halu Oleo.

Pinto, Z. (2015). Study of coastal community behavior that causes environmental damage: A case study on Kuwaru Beach, Poncosari Village, Srandakan District, Bantul Regency, DIY Province. Jurnal Wilayah dan Lingkungan. 3(3): 163-174.

Pitcher, T.J. and Preikshot, D. (2001). Rapfish: A rapid appraisal technique to evaluate the sustainability status of fisheries. Fisheries Research. 49(3): 255-270. doi: https://doi.org/10.1016/S0165-7836(00)00205-8.

Priyarsono, D.S. and Backe, D. (2007). Agriculture-based industry: The direction of industrial development in Indonesia. Journal SOCA. 8: 256-264.

Rahni, N.M. (2011). Sorghum (Morphology, Physiology, Ecology, Cultivation Technology and Development Prospects). Bandung, Indonesia: UNPAD Press.

Rustiadi, E., Saefulhakim, S. and Panuju, D.R. (2017). Regional Planning and Development. 2nd ed. Jakarta, Indonesia: Yayasan Obor Indonesia.

Sari, N.F., Ridwan, R.N. and Widyastuti, Y. (2017). The quality of corn silage product from technopark of Banyumulek Lombok, West Nusa Tenggara. Bulletin of Animal Science. 41(2): 156-162. doi: https://doi.org/10.21059/buletinpeternak.v41i2.15513.

Setimela, P.S., Mhike, X., MacRobert, J.F. and Muungani, D. (2006). Maize Hybrids and Open-pollinated Varieties: Seed Production Strategies. In: Strategies for 27 Strengthening and Scaling up Community-based Seed Production. [Setimela, P.S., Kosina, P., (eds)], Mexico, DF: CIMMYT FAO.

Soekartawi. (2003). Economic theory of production: With the subject of Cobb-Douglas function analysis. Jakarta, Indonesia: Raja Grafindo Persada.

The World Café Community Foundation. (2015). Quick reference guide for hosting world café. Greenbrae, CA: The World Café Community Foundation.

Theresia, A. and Toto. (2014). Community-based development. Jakarta, Indonesia: Penerbit Alfabeta.

Yuwono, T. (2016). Building Agriculture: Building Food Sovereignty. Yogyakarta, Indonesia: UGM Press.