Research article

http://www.revistas.unal.edu.co/index.php/refame

Revista Facultad Nacional de Agronomía

Assessment of base areas for local sago-based food development in Southeast Sulawesi, Indonesia

UNIVERSIDAD NACIONAL DE COLOMBIA

Evaluación de las áreas de base para el desarrollo de alimentos locales basados en sagú en el sudeste de Sulawesi, Indonesia

https://doi.org/10.15446/rfnam.v79.119467

Muhtar Amin[1]*, Muh Obi Kasmin[1], Kartomo Kartomo[2], Irwansyah Irwansyah[3] and Andi Mariani Ramlan[4]

Keywords:
Agro-industry
Commodity development
Location quotient
Share analysis

Citation: Amin M, Kasmin MO, Kartomo K, Irwansyah I and Ramlan AM (2026) Assessment of base areas for local sago-based food development in Southeast Sulawesi, Indonesia. Revista Facultad Nacional de Agronomía Medellín 79: e119467. doi: https://doi.org/10.15446/rfnam.v79.119467

ABSTRACT

Sago is not only a source of food for most people in Southeast Sulawesi, but also a cultural identity and tradition in various community activities, in addition to being one of the main staple products in the region. This study aims to assess the base area of local sago food processing and to determine the distribution of this superior commodity through the growth and share of local sago food processing. Assessing the base area of the region for local sago food production can serve as the basis for the evaluation and design of policies. The research results show that five of the eight districts are base areas for local sago food development, characterized by an LQ value of more than one. These areas are South Konawe (3.1), Konawe (2.6), North Konawe (2.5), East Kolaka (1.8), and Kolaka (1.2). Concerning the potential base area, three regencies fell into the superior category, three regencies belonged to the static category, and one regency was classified as potential and dominant. These findings reflect the prospects of local sago-based food processing and support its development as a leading commodity. Encouraging sago processors to maintain and develop the enterprises could support the provision of carbohydrate needs for consumption. There has been hope for the future of the local sago food processor thanks to its inclusive development in resource-rich base areas.

RESUMEN

Palabras clave:
Agroindustria
Desarrollo de productos básicos
Cociente de ubicación
Análisis de participación

El sagú no solo es una fuente de alimento para la mayoría de las personas en el sudeste de Sulawesi, sino también una identidad cultural y una tradición en diversas actividades comunitarias, además de ser uno de los principales productos básicos de la región. Este estudio tiene como objetivo evaluar el área base del procesamiento local de sagú y determinar la distribución de este producto superior a través del crecimiento y la participación de dicho procesamiento. La evaluación del área base de la región para la producción local de sagú puede servir como base para la evaluación y el diseño de políticas. Los resultados de la investigación muestran que cinco de los ocho distritos son áreas base para el desarrollo local de sagú, caracterizadas por un valor de LQ superior a uno. Estas áreas son Konawe Sur (3,1), Konawe (2,6), Konawe Norte (2,5), Kolaka Este (1,8) y Kolaka (1,2). En cuanto a las áreas base potenciales, tres regencias se ubicaron en la categoría superior, tres regencias pertenecieron a la categoría estática y una regencia fue clasificada en la categoría potencial y dominante. Estos hallazgos reflejan las perspectivas del procesamiento de alimentos locales a base de sagú y respaldan su desarrollo como un producto líder. Fomentar el mantenimiento y desarrollo de las empresas de procesamiento de sagú podría contribuir a cubrir las necesidades de carbohidratos para el consumo. Existe esperanza para el futuro de la industria local de procesamiento de sagú gracias a su desarrollo inclusivo en zonas ricas en recursos.

[1]Department of Agribusiness, Universitas Sembilanbelas November Kolaka, Indonesia. muhtaramin1971@gmail.com, muhammadrobby441@gmail.com
[2]Department of Economic Development, Universitas Sembilanbelas November Kolaka, Indonesia. bungkartomo@gmail.com
[3]Department of Animal Husbandry, Universitas Sembilanbelas November Kolaka, Indonesia. peternakanirwansyah@gmail.com
[4]Department of Mathematics, Universitas Sembilanbelas November Kolaka, Indonesia. andi.21018@mhs.unesa.ac.id
*Corresponding author

Received: June 10, 2025; Accepted: October 19, 2025

The Indonesian sago industry has significant potential but remains limited, particularly in regions such as the Maluku Islands, Papua New Guinea, Sumatra, and Sulawesi (Purbaningsih et al. 2023). Sago can be developed as a sustainable agro-industry, particularly in peatlands, with high, although currently low, productivity potential (Nursalam 2018). Key challenges include the shrinking sago plantations due to land conversion and low productivity, necessitating the development of a more integrated sago industry in various regions (Timisela et al. 2021). Southeast Sulawesi is a region with significant potential for sago (*Metroxylon sagus Rottb*); however, the potential of sago at the farmer level is not yet optimally exploited at present (Nirmala et al. 2017). The area of sago plantations in Southeast Sulawesi reaches 4,567 hectares, with a total sago starch production of 3,001 tons of sago starch (Saediman et al. 2021). The sago product in Southeast Sulawesi is distributed across eight regencies and cities, namely Konawe Regency, Kolaka, South Konawe, Wakatobi, North Kolaka, North Konawe, East Kolaka, and Kendari City.

The development of the sago agribusiness in Indonesia, particularly in Southeast Sulawesi, must consider at least three aspects: social, economic, and environmental (Fachrizal et al. 2022; Puspantari et al. 2023). From a social perspective, the existence of the sago agribusiness, in addition to supporting national food security, also contributes to the preservation of cultures and traditions. For some communities in Southeast Sulawesi, sago is not only a food ingredient but also a symbol of local traditions and culture (Nursalam et al. 2025). Economically, sago can serve as a source of income for local communities, support dietary diversification, function as an export commodity, and act as a raw material for various non-food industries. Moreover, sago palms can provide an alternative resource for marginal lands, as they are environmentally friendly and resilient to climate change (Ehara et al. 2018).

Sago production is one of the products that has received great attention from the government to be developed as an alternative local food (Fachrizal et al. 2022; Puspantari et al. 2023), where many derivative products have emerged from Sago. Previously, the production of sago producers was only sago palm, which was then processed into a food ingredient called sinonggi (Dewayani et al. 2022). The income generated by producers from sago production activities tends to be low because the target market is only in the Southeast Sulawesi region (Nursalam et al. 2023). However, currently, along with increasing technological developments, sago processing producers have been able to innovate, from processed sago to sago flour and snack ingredients such as sago biscuits.

The development of processed sago products that become commodities and have significant growth capacity will promote optimal regional growth while providing greater profits to producers (Pramana et al. 2021). This is in line with the concept of sustainable agricultural development (Donowati 2018). The importance of the sustainability aspect lies in the fact that agriculture is closely linked to the greenhouse effect, water quality, pollination, carbon absorption, food supply, and employment opportunities, and conversely, agricultural practices contribute to ecological degradation, climate change, land damage, and pollution from phosphorus and nitrogen fertilizers (Timisela et al. 2022; Sutrisno 2023).

Determining the commodity of a region is done using the Location Quotient (LQ) approach. The LQ approach aims to find out which products can be used as development priorities or commodities for a region (Tallo et al. 2018). Apart from this, the development of a region or area can proceed more efficiently if the basic sectors or products can be optimized (Nurlina et al. 2023). By knowing the commodity of sago processed products, the government will be able to formulate policies that can optimize the development of local sago food processing enterprises for regional development.

Other problems that often arise among sago producers and entrepreneurs include flour processing costs, which are still high while the sale value is relatively low, and the market system is limited (Putri et al. 2020). The bargaining position of sago producers is too weak due to the monopolistic system of middlemen and prices set by big traders. To overcome this problem, the step to be taken is to formulate a management model for the sago agro-industry. This step was taken to find an effective design for sago processing so that commercial production of sago

is not only in the form of primary production but can be directed to commercial products through the agro-industrial system of sago products (Ben Ruben et al. 2019). This study aims to identify the base areas of local sago-based food processing and to determine the spatial distribution of this leading commodity by analyzing the growth and market share of local sago food processing activities.

MATERIALS AND METHODS

This research was conducted in the province of Southeast Sulawesi, Indonesia, in 2024. The population in the study was 830, and the number of samples in this study consisted of 86 local sago food processors, 12 district governments, and 3 provincial governments working in the plantation service and food crops service. The determination of the number of processor respondents was carried out using the Slovin method, with a margin of error of 10%, while the determination of district government and provincial government respondents was carried out using the purposive sampling method (direct/intentional appointment samples).

This study uses primary data and secondary data. Primary data through field surveys and interviews with the entire research sample and all stakeholders. Secondary data was obtained from government reports and academic publications. Data collection in this study was carried out through a direct interview process with research respondents using a questionnaire instrument that had undergone validity and reliability testing. The collected data is then tabulated and analyzed.

Data collected in this study were analyzed using the location quotient (LQ) formula (Heldayani 2022; Alibekova et al. 2023) to analyze the base and non-base areas of the local sago food processor with Equation 1:

$$LQ = \frac{Xij / Xin}{Xrj / Xm} \quad (1)$$

Where X_{ij} is the sago commodity production in districts in Southeast Sulawesi, X_{in} is the production of all food commodities in districts in the Southeast Sulawesi region, X_{rj} is the sago commodity production in Southeast Sulawesi, and X_m is the production of all food commodities in Southeast Sulawesi.

Share analysis (Capello and Cerisola 2023) to analyze the growth rate of the local sago food processor with Equation 2:

$$R_{ij} = G_{ij} + M_{ij} + C_{ij} \quad (2)$$

Where R_{ij} refers to total effect, M_{ij} implies growth; C_{ij} indicates regional share as the competitive advantage of local sago foods in districts in Southeast Sulawesi; and G_{ij} represents the growth rate of local sago foods in districts in Southeast Sulawesi.

RESULTS AND DISCUSSION

Distribution of Local Sago Food Processor

In Southeast Sulawesi (Figure 1), local sago processing is a widespread and integral activity across the region. The growth of regional sago food processing enterprises is supported by the abundant availability of raw materials and a strong demand from both domestic and international consumers. Notably, Konawe Regency hosts the highest concentration of sago processors, reflecting its capacity to leverage local resources effectively. In contrast, Kolaka Regency has the fewest local sago processors, which may indicate potential limitations related to resource availability or market access. This distribution highlights the varying capacities of different regencies within Southeast Sulawesi to support and expand sago processing activities, underscoring the need for targeted strategies to optimize production and meet consumer demand.

The distribution of local sago processors varies significantly across Southeast Sulawesi. For example, Konawe Regency (3), with its abundant sago palm resources, has the highest number of processors, reflecting its capacity to support extensive sago food production. In contrast, Kolaka Regency (5) has the fewest processors, indicating potential constraints in raw material availability or market access. This distribution pattern underscores the importance of leveraging local resources to optimize sago processing activities.

Concentration Area of Local Sago Food Processors

To enhance the efficiency of local sago food development, it is crucial to determine the concentration of processing activities at the regency level. This study employs the Location Quotient (LQ) approach to identify specific areas, districts, or regions that could serve as

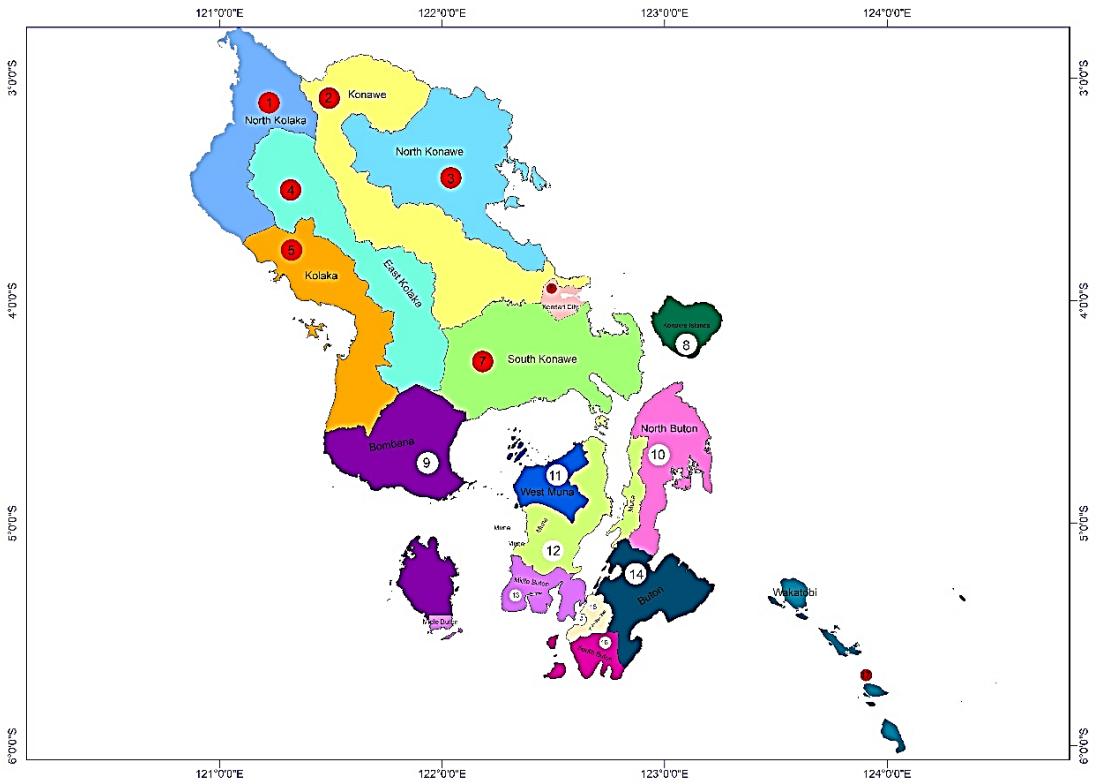

Figure 1. Distribution of local Sago processors in Southeast Sulawesi by district-city (The red mark indicates the districts producing sago products in Southeast Sulawesi Province).

concentrated bases for local sago food development. By pinpointing these strategic locations, the study aims to optimize resource allocation and bolster the sago industry's growth potential (Zyuzin et al. 2020). The LQ distribution of each local sago food-producing region in Southeast Sulawesi is shown in detail in Figure 2.

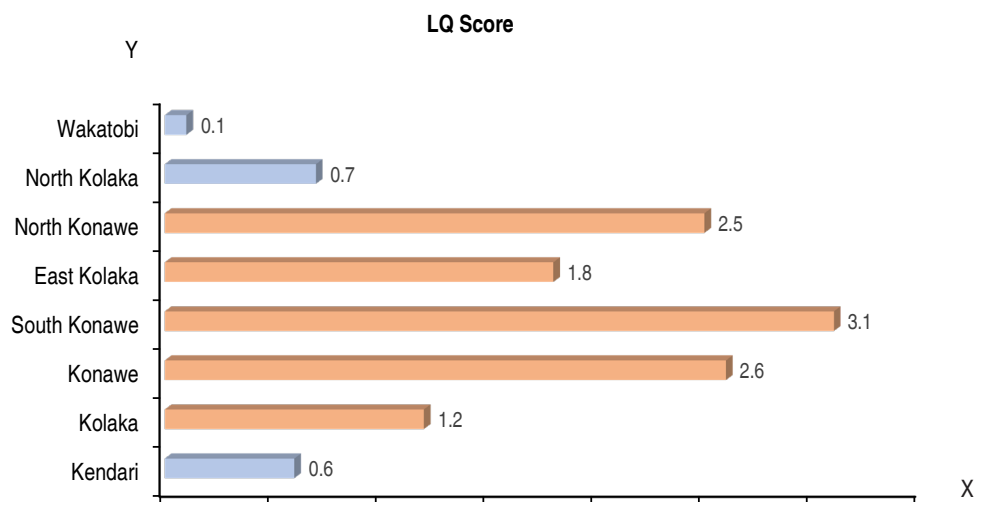

Figure 2. Distribution of LQ values based on urban districts in Southeast Sulawesi. Y = Name of district, X = LQ value, blue color: Base area, and orange color: non-base area.

Figure 3 shows the district-city areas that are the core areas of local sago food production in Southeast Sulawesi. The Location Quotient (LQ) analysis provides valuable insights into the concentration areas of local sago food processors. Regions with an LQ coefficient of greater than or equal to 1, such as South Konawe and Konawe Regency, are identified as base areas for sago food development. These regions possess a comparative advantage in sago production, enabling them to become primary suppliers of sago foods both within and beyond the province. The advantages of this region, apart from the large number of sago trees, especially in Konawe and South Konawe, also include processed sago products such as sago biscuits, bagea cakes, sago lempe, and sago bread. The strategic development of these base areas can enhance the efficiency and sustainability of sago food production, ensuring a steady supply to meet consumer demand.

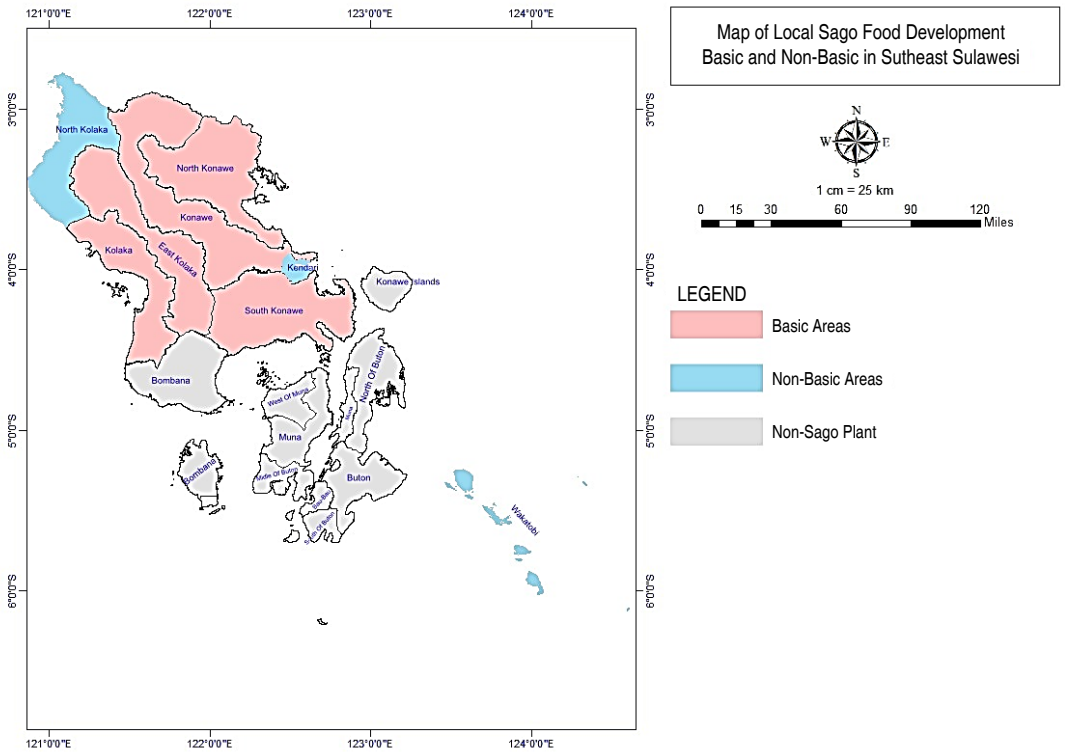

Figure 3. Local sago food processing specialization by base and non-based areas.

Five out of the eight regencies in Southeast Sulawesi have been classified as base areas for local sago food, according to Figure 2, LQ analysis results, which have an LQ coefficient of ≥ 1. The second-highest LQ coefficient region was found to be South Konawe and Konawe regency. As a result of their comparative advantage in developing the local sago food commodity to become one of the primary sources of carbohydrates other than rice, corn, and other sources, both regions could contribute to the local sago food supply to meet consumers' needs. The neighborhood's closest market provided the inhabitants with easy access to locally produced sago food items; they could even have the sago delivered (Pominova et al. 2021). Furthermore, there has been a price differential in adjacent places, and surplus production of goods would be transferred to those areas (Kasmin et al. 2023).

The comparative advantage of the location in promoting the growth of the sago plant population was one of the primary factors used in the evaluation of the local sago food development zones. This criterion is represented by the LQ index, which also lists local sago food goods that should be given development priority (Nursalam et al. 2023). As seen in Figure 3, the analysis conducted for this study aimed to pinpoint Southeast Sulawesi

regencies or regions that could be used as bases or non-bases to produce regional sago foods.

The distribution of base districts, indicated in orange on the map in Figure 3, with an LQ coefficient of ≥ 1, is shown. The base areas of local sago food development, which span five regencies, are indicated by the green areas on the local sago food map. On the other hand, the 11 regencies that make up the blue areas are non-based areas. Positive effects that benefit a region's economic development, employment, and income have emerged because of product concentration and economic specialization (Pominova et al. 2021). The green spaces might develop into new markets for sales when they are close to other areas. In addition, the effectiveness of the company's products improves, supplier and customer interdependence grow, and the company's rate of innovation accelerates.

Identification of regions based on Growth and Stock Value

Table 1 (BPS-Statistic of Southeast Sulawesi 2022) shows that the local sago food processor in Southeast Sulawesi experienced an average growth rate of 78,86% between 2019 and 2023. The potential for regional domination was suggested by the contribution values, which ranged from highest to lowest, in the examination of the local sago food processor in this regency from 2019 to 2023. After this investigation, 60% of the regency was deemed to be "potential areas" for the establishment of a local processor of sago foods.

Table 1. Growth and Share of Local Sago Food Processor in Southeast Sulawesi by Regency, 2024.

Growth and Share of Local Sago Food Processor											
No	Regency	Growth (%)				Share (%)					Identification
		2019-2020	2020-2021	2021-2022	2022-2023	2019	2020	2021	2022	2023	
1	Wakatobi	2.14	0.87	0	0	1.09	1.22	1.22	1.22	1.42	Static
2	North Kolaka	2.28	2.02	1.04	0.83	1.14	1.21	1.21	1.24	1.31	Static
3	North Konawe	2.18	2.00	3.24	9.43	4.46	4.18	4.76	4.72	5.65	Superior
4	East Kolaka	2.36	2.12	2.16	5.05	1.27	1.25	1.36	1.38	1.54	Dominant
5	South Konawe	2.8	2.11	3.65	8.72	5.37	5.01	6.21	6.34	6.87	Superior
6	Konawe	3.41	2.98	3.44	9.28	6.72	5.44	7.14	7.28	7.86	Superior
7	Kolaka	0.21	0.18	0.18	0.43	6.52	6.92	6.94	6.87	7.31	Potency
8	Kendari	3.28	0.99	0	0	1.16	1.25	1.24	1.24	1.27	Static
Total in each period Southeast Sulawesi		**18.14**	**13.27**	**13.71**	**33.74**	**26.59**	**26.48**	**30.08**	**30.29**	**33.23**	

Data Analysis BPS (2024).

The local sago food processor was highly and positively correlated among areas with growth and share values being in the same category. The higher the local sago food processor in a regency, the greater the contribution to the total local sago food processor rate in the whole province. The development of areas in the superior, potential, and dominant categories has depicted positive potential in providing local sago food. Regencies with superior, potential, and dominant categories could boost the supply and distribute it to other regencies (Yusuf et al. 2021).

The higher the local sago food processor in an area, the greater the growth rate, indicating a more prominent opportunity for the area to become a leading sector (Nurlina et al. 2023). The gradual increase in the local sago food processor might be the result of the rising demand for local sago food among consumers. Consumption of local sago food has made a significant contribution to the carbohydrate consumption of most people in Southeast Sulawesi.

The findings unmistakably showed that the rise of regional sago food production in superior areas might have a major impact on regional economic development, including the reduction of poverty and improvement of food security (Ehara et al. 2018). To

attain food security and sustainability in Southeast Sulawesi, the local government might provide regional development planning, devise regulations for local sago food processors, and base decision-making on the concentrated regions that have been identified. The local sago food agribusiness development program should be implemented with a focus on community empowerment, which can be achieved through bolstering production systems, enhancing market accessibility, fortifying institutions, and guaranteeing the longevity of local sago food processors.

CONCLUSION

The local sago processing industry has significant development potential, supporting increased rural income and carbohydrate intake. The base areas for local sago food development are South Konawe, Konawe, North Konawe, East Kolaka, and Kolaka, with LQ values greater than one, supported by the analysis of the Growth and Share of Local Sago Food Processors. Based on these findings, we recommend that the development of the local sago food processing industry be more efficient if carried out in these base areas. Local sago food commodities can be improved and preserved by establishing a local sago processing industry centered in the central region and expanding resources. Finally, it is recommended to conduct a study on the local sago food development model based on the regional characteristics of Southeast Sulawesi.

ACKNOWLEDGMENTS

All authors would like to thank all parties who have helped so that this research can be carried out properly.

CONFLICT OF INTERESTS

All authors declare that there is no conflict of interest in conducting this research.

REFERENCES

Alibekova G, Alzhanova F, Osmanov Z and Omarov A (2023) Regional specialization and diversification of industries in Kazakhstan. Journal of Eastern European and Central Asian Research (JEECAR) 10:898–906. https://doi.org/10.15549/JEECAR.V10I5.1096

Badan Pusat Statistik Sulawesi Tenggara (2024) Produksi Perkebunan Menurut Kabupaten Kota dan Jenis Tanaman. https://sultra.bps.go.id/id/statistics-table/1/NDY4MCMx/produksi-perkebunan-menurut-kabupaten-kota-dan-jenis-tanaman-ton-2022-dan-2023.html

Ben Ruben R, Vinodh S and Asokan P (2019) State of art perspectives of lean and sustainable manufacturing. International Journal of Lean Six Sigma 10:234–256. https://doi.org/10.1108/IJLSS-11-2016-0070/FULL/HTML

Capello R and Cerisola S (2023) Industrial transformations and regional inequalities in Europe. Annals of Regional Science 70:15–28. https://doi.org/10.1007/S00168-021-01097-4

Dewayani W, Suryani, Arum RH and Septianti E (2022) Potential of sago products supporting local food security in South Sulawesi. In: IOP Conference Series: Earth and Environmental Science. IOP Publishing Ltd. https://doi.org/10.1088/1755-1315/974/1/012114

Donowati T (2018) Potency of sago (*Metroxylon* spp) crops for food diversity. Biodiversity International Journal 2:239–240. https://doi.org/10.15406/BIJ.2018.02.00066

Ehara H, Toyoda Y and Johnson DV (2018) Sago palm: Multiple contributions to food security and sustainable livelihoods. Sago Palm: Multiple Contributions to Food Security and Sustainable Livelihoods 1–330. https://doi.org/10.1007/978-981-10-5269-9/COVER

Fachrizal R, Ginting NM, Nurliah et al (2022) The potential of sago processing in supporting farmers' welfare. In: IOP Conference Series: Earth and Environmental Science. Institute of Physics. https://doi.org/10.1088/1755-1315/1107/1/012086

Heldayani E (2022) Implementasi Metode Location Quotient (LQ) untuk Analisis Potensi Komoditas Unggulan Subsektor Hortikultura di Kabupaten Muara Enim. Geodika: Jurnal Kajian Ilmu dan Pendidikan Geografi 6:220–231. https://doi.org/10.29408/GEODIKA.V6I2.6496

Kasmin MuhO, Helviani H and Nursalam N (2023) Identifikasi Komoditas Hortikultura Basis dalam Perspektif Pertanian Berkelanjutan di Kabupaten Kolaka, Indonesia. Agro Bali: Agricultural Journal 6:211–217. https://doi.org/10.37637/AB.V6I1.1043

Nirmala IR, Trees, Suwarni and Pramono MS (2017) Sago worms as a nutritious traditional and alternative food for rural children in Southeast Sulawesi, Indonesia. Asia Pac J Clin Nutr 26: s40–s49. https://doi.org/10.6133/APJCN.062017.S4

Nurlina, Andiny P and Muda I (2023) Development strategy for disadvantaged regions based on leading sectors in the Eastern Aceh Region. International Journal of Professional Business Review 8:e01378. https://doi.org/10.26668/businessreview/2023.v8i4.1378

Nursalam N (2018) Analyzing the efficient allocation of sago processing business production factors in East Kolaka District. Indonesian Journal of Business and Entrepreneurship 4:45-54. https://doi.org/10.17358/ijbe.4.1.45

Nursalam N, Kartomo K, Kasmin MO and Suparman S (2023) Welfare of local sagu food processing communities in East Kolaka District. Bulletin Penelitian Social Ekonomi Pertanian Fakultas Pertanian Universitas Haluoleo 25:161–167. https://doi.org/10.37149/BPSOSEK.V25I2.872

Nursalam N, Kartomo K, Amin M, Afa M, Kasmin MO et al (2025) Agribusiness design of local sago food in Southeast Sulawesi. WSEAS Transactions on Business and Economics 22:297-304. https://doi.org/10.37394/23207.2025.22.29

Pominova M, Gabe T and Crawley A (2021) The pitfalls of using location quotients to identify clusters and represent industry specialization in small regions. International Finance Discussion Paper 2021:1–25. https://doi.org/10.17016/IFDP.2021.1329

Pramana A, Adhianata H, Zamaya Y et al (2021) Acceleration of sago food diversification in improving the welfare of sago farmers in

Riau Province. In: IOP Conference Series: Earth and Environmental Science. IOP Publishing Ltd. https://doi.org/10.1088/1755-1315/934/1/012091

Purbaningsih Y, Nursalam N, Prihantini CI, Hasbiadi H, Karim A and Sejati AE (2023) Development model of sago agroindustry small and medium enterprises (SMEs) in Southeast Sulawesi Province: Income and Strategy Analysis. Journal Habitat 34:60-71. https://doi.org/10.21776/UB.HABITAT.2023.034.1.6

Puspantari W, Cahyana PT, Saepudin A et al (2023) Sago rice as an environmentally sustainable food. In: BIO Web of Conferences. EDP Sciences. https://doi.org/10.1051/bioconf/20236903012

Putri DA, Nadja RA and Salman D (2020) The role of sago (*Metroxylon* sp.) as staple food in supporting food security of household and community in Baloli Village, Masamba District, North Luwu Regency. Anjoro: International Journal of Agriculture and Business 1:52–58. https://doi.org/10.31605/anjoro.v1i2.885

Saediman H, Helviani H, Said LR et al (2021) Market structure of sago starch in Southeast Sulawesi, Indonesia. WSEAS Transactions on Business and Economics 18:628–635. https://doi.org/10.37394/23207.2021.18.62

Sutrisno S (2023) Analysis of leading sectors in improving the economy East Java Province in 2016-2020. International Journal of Multidisciplinary: Applied Business and Education Research 4:305–311. https://doi.org/10.11594/IJMABER.04.01.29

Tallo AJ, Arianti SP, Abdillah F et al (2018) Typology analysis and leading sector of East Nusa Tenggara Province in 2017. J Phys Conf Ser 1114:012122. https://doi.org/10.1088/1742-6596/1114/1/012122

Timisela NR, Masyhuri M and Darwanto D (2021) Development strategy of sago local food agroindustry using analytical hierarchy process method. Agraris Journal 7:36-52. https://doi.org/10.18196/agraris.v7i1.9378

Timisela NR, Siahaya WA, Hehanussa MM and Polnaya FJ (2022) Condition of plantation and development strategy of sago garden. International Journal of Sustainable Development and Planning 17:421–432. https://doi.org/10.18280/IJSDP.170207

Yusuf DN, Asniah, Sutariati GAK and Muhidin (2021) The potential of sago as a local food ingredient to support the food security in South Konawe. In: IOP Conference Series: Earth and Environmental Science. IOP Publishing Ltd. https://doi.org/10.1088/1755-1315/807/2/022077

Zyuzin AV, Demidova OA and Dolgopyatova TG (2020) Localization and diversification of russian economy: Regions' and Industries' peculiarities. Spatial Economics 2020:39–69. https://doi.org/10.14530/SE.2020.2.039-069