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A Value Chain Analysis of Small-Scale Sago Industries: A Case Study of South Sulawesi, Indonesia

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Abstract: A value chain analysis is conducted to identify the requirements for upgrading the quality of sago starch, which enables producers to gain enhanced value, or for diversifying the product lines served. A case study of a sago starch value chain was carried out in two different locations around South Sulawesi. The characteristics of small-scale sago industries and their production were also examined. The study revealed that dried sago production is the most profitable and has the highest significant value-added process as compared to wet sago and *dange*.

Keywords: profitability, sago palm, South Sulawesi, value chain

Introduction

Metroxylon sagu Rottb., known widely as sago palm, is a tropical crop containing a large amount of starch in its trunk with average productivity four times that of paddy rice (Ishizuka et al., 1995). According to the Directorate of Perennial Crops (2015), sago palm is a native Indonesian plant covering a total area of around 107,906 hectares with a total production of 155,061 tons, mostly in Riau, Papua, Maluku, and Sulawesi. Based on the World Development Indicators database from the World Bank, the total gross domestic product (GDP) in Indonesia was worth 932.3 billion US dollars in 2016 (World Bank, 2018), and sago exports accounted for only 4.6 million US dollars in 2016. This value was far below other crops, such as palm oil (14.7 billion US dollars) and rubber (2.4 billion US dollars) (Directorate of Perennial Crops, 2015). In addition, the sago palm national program constituted only 0.05% of the total state budget from 2012–2014 (Trisia et al., 2016). In fact, regardless of numerous advantages, sago is still not treated as a priority crop for development to support economic and food security in Indonesia.

Many studies have been conducted to determine the effect of market disparities on food availability and price transmission in Indonesia (Warr and Yusuf, 2013; Varela et al., 2013; Maspaitella et al., 2017). Some case studies have been conducted for a particular region (Sahara and Wicaksena, 2013; Khaeron et al., 2016; Irawanti et al., 2017); however, none has been conducted recently to estimate the status of value-added sago that could make sago products attractive for high-value market opportunities. To date, there is no empirical evidence of whether, and to what extent, added value and price transmission can be considered to be efficient for different actors in the sago industry. This situation indicates the need for analyzing the role played by markets in South Sulawesi, especially for small-scale sago industries.

This paper targets these gaps through identifying the nature of sago production of each small-scale sago industry and analyzing a wide range of issues pertaining to value chains of sago products. In examining this issue, we explain the methodology in Section 2, and

then in Section 3, we briefly highlight the key distinctive characteristics of actors. In Section 4, we focus on the sago value chain in South Sulawesi. In the Conclusion, we consider the wider implications of our analysis. This case study involves only two locations with a limited number of respondents. However, this study is essential as a baseline for understanding the value chain of small-scale sago industries in Indonesia.

2. Methodology

A small survey with a limited number of respondents was conducted in February 2018 in North Luwu Regency and Makassar City (Figure 1). Research locations were defined based on spatial geography. North Luwu Regency is one of the largest sago-producing areas in South Sulawesi. Meanwhile, Makassar City is a central location of the sago business in the eastern part of Indonesia.

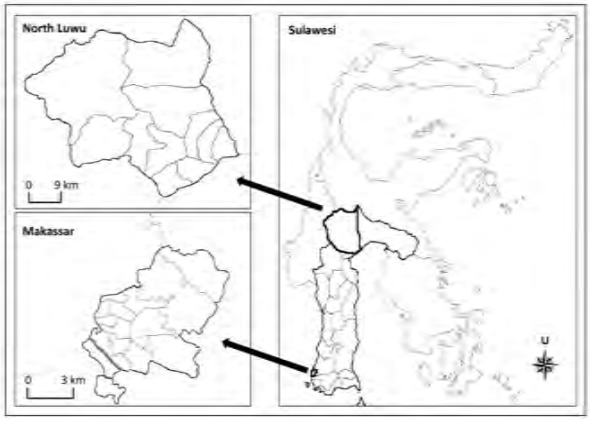

Fig 1. Map of research locations

In this study, 25 interviews were completed among sago owners, sago farmers, *dange* producers, dried sago producer, middlemen, and retailers (Table 1). Purposive sampling was used as a tool for informant selection in this case study. For example, only one respondent was a dried sago producer because dried sago is not a common product in South Sulawesi. In fact, the respondent was chosen because the dried sago product is the first local product that can be found in a majority of souvenir shops and modern markets (convenient stores and mini markets). In addition, the selected middlemen and retailers are the biggest actors who have extensive networks for sago distribution in South Sulawesi.

Sago market performance was tested in this study using value chain analysis, which provides valuable information regarding factors influencing actor performance. The value chain approach was developed by Michael Porter in the 1980s (Porter, 1985). At each stage in a market chain, the product changes hands through chain actors, and costs are

Table 1. Definitions of important terms and numbers of respondents

Term	Definition	Sources	Number of respondents
Sago owner	A person who owns sago palm. In South Sulawesi, sago palm ownership is mostly inherited, which means that claims have been made by ancestors and passed on from one generation to the next.	Laufa (2004); Trisia et al. (2016)	5
Sago farmer	A person who extracts the starch from sago trunks. Several terms such as "processors," "sago farmers," and "producers" are identified in the papers. However, in this study, we use the term of "sago farmer," which is derived from the Indonesian term of *petani sagu*. The final product of a sago farmer is wet sago.	Oates and Hicks (2002); Metaragakusuma et al. (2017)	7
Dange producer	A person who produces or makes roasted sago. Roasted sago is called *dange* in South Sulawesi and *sagu lempeng* in Maluku and Papua.	Metaragakusuma et al. (2016)	3
Dried sago producer	A person who produces dried sago that is packed into plastic packaging. Dried sago is not a common product sold in South Sulawesi; however, in 2014, we found a dried sago product in souvenir shops. It is acknowledged by local government as the first local product of dried sago with attractive modern plastic packaging.	Metaragakusuma et al (2015); Metaragakusuma et al. (2017)	1
Middleman	A person who acts as an intermediary between producers and consumers.	Oguoma et al. (2010)	4
Retailer	A person or business that buys products from a producer or middleman and sells them to consumers. Some references mentioned two types of retailers: traditional and modern retailers. However, in this paper, we use the term "special retailer" to define a traditional retailer.	Sunanto (2012); Rangarajan (2016)	5

incurred at each transaction. Generally, some forms of value are added (Louw et al., 2008). The value chain framework is used as a powerful analytical tool for strategic planning, and it aims to maximize value creation while minimizing costs (Mumbeya, 2011). Based on the data collected, we calculated the added value of sago using Hayami's method (Hayami et al., 1987).

3. The distinctive characteristics of sago palm distribution in South Sulawesi

The major actors in sago starch distribution studied in South Sulawesi are sago palm owners, sago farmers, *dange* producers, a dried sago producer, middlemen, and retailers in either traditional or modern markets. Table 2 shows the number of respondents interviewed in each category of the process with a summary of the characteristics of the respondents, including age, gender, level of formal education, and work experience.

Table 2. Characteristics of respondents

Characteristic	Respondent group					
	Sago owner	Sago farmer	*Dange* producer	Dried sago producer	Middleman	Retailer
	5 (20%)	7 (28%)	3 (12%)	1 (4%)	4 (16%)	5 (20%)
Gender						
Male	5 (100%)	7 (100%)	0 (0%)	1 (100%)	0 (0%)	0 (0%)
Female	0 (0%)	0 (0%)	3 (100%)	0 (0%)	4 (100%)	5 (100%)
Age, years						
26–35	1 (20%)	2 (28.5%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
36–45	1 (20%)	2 (28.5%)	2 (66.7%)	0 (0%)	4 (100%)	3 (60%)
>45	3 (60%)	3 (43%)	1 (33.3%)	1 (100%)	0 (0%)	2 (40%)
Education						
Elementary school	3 (60%)	4 (57%)	3 (100%)	0 (0%)	2 (50%)	1 (20%)
Junior high school	0 (0%)	1 (14.5%)	0 (0%)	0 (0%)	1 (25%)	3 (60%)
Senior high school	2 (40%)	2 (28.5%)	0 (0%)	0 (0%)	1 (25%)	1 (20%)
University	0 (0%)	0 (0%)	0 (0%)	1 (100%)	0 (0%)	0 (0%)
Work experience, years						
<5	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
5–15	2 (40%)	3 (43%)	2 (66.7%)	1 (100%)	0 (0%)	1 (20%)
16–25	0 (0%)	0 (0%)	1 (33.3%)	0 (0%)	2 (50%)	3 (60%)
>25	3 (60%)	4 (57%)	0 (0%)	0 (0%)	2 (50%)	1 (20%)

The gender category of respondents revealed that the sago owners, sago farmers, and dried sago producer were all males (100%). This finding supports the empirical evidence of previous studies that sago work is done by men (Hermin, 2007; Metaragakusuma et al., 2017; Trisia et al., 2017). This is because extracting sago starch requires high mobilization and effort. Women in the sago business were involved only in the *dange* industry and as middlemen and retailers in traditional markets. This result is confirmed by Sudarman et al. (2010) and FAO (2011), who found that being a seller does not require intense energy levels, provides flexible working hours, and, hence, are suitable for women. However, this finding is in contrast with those of MeMurrian and Rhey (2001) and Puspitawati (2013), who found that females are perceived to be less knowledgeable about selling products than are males.

In terms of age, 12% of total respondents were in the age group of 26 to 35 years, 48% were 36 to 45 years old, and 40% were older than 45. Specifically, the main group of respondents for the sago owner, sago farmer, and dried sago producer categories were those older than 45 years. Meanwhile, the majority of respondents from the *dange* producer, middlemen, and retailer categories were between 36 and 45 years old. In fact, most of the respondents were of a mature working age.

Most respondents had reached elementary school level. The highest level of formal education of the respondents was university level, which was the dried sago producer. The low formal education level of a large portion of the respondents may be due to the status of the sago business as an informal activity that

does not require any special skill. The data also revealed that sago owners and sago farmers have work experience of more than 25 years, whereas the *dange* and dried sago producers tended to have less work experiences (5–15 years). This finding was due to the lower popularity of dried sago products and *dange*. Middlemen and retailers tended to have more work experiences (more than 15 years). We assume the middlemen and retailers who have more work experiences will have more chances to extend their sago distribution networks. In addition, extensive experience is necessary to develop the skills needed to judge the quality of sago starch to buy.

3.1 Sago farmers

In South Sulawesi, a sago farmer is called *pa`sampe*, and the process of sago extraction is called *ma`nokok sagu*. Local people call their workshops *pabrik sagu* (sago factory), even if they have only a rasping machine. Our previous research, in 2016, showed that sago farmers in North Luwu were divided into three types based on their technology adoption: (1) technology transition from traditional to small-scale, (2) small-scale technology, and (3) semi-mechanized technology. However, in 2018, the semi-mechanized factory (type 3) was subsequently closed down due to overcapacity. A former worker at the factory said that it was difficult to get more than 10 sago trunks (10 sago trees) a day in North Luwu.

Types 1 and 2 sago farmers are different in terms of workers, practices, and profit sharing between sago owners and machine owners. Type 1 farming is practiced by an individual, where sago palms are cut down and processed in a small pond. After cutting a trunk with an ax, the split log is rasped by a rasping machine. The rasped sago mash is put into a leaf sheath of sago palm, and water is then added to it. Finally, the sago mash is kneaded by hand, which allows water carrying the starch to pass through a sieve into a suitable container. After kneading, the remaining pith is discarded, and wet sago is ready to be harvested (Figure 2). The whole process takes 14–15 days for one sago palm trunk.

For type 2 farming, sago production is practiced by three workers. A chainsaw is used to cut sago trees, and rasping is done using engine-powered rasps. The rasped sago mash is then trampled by foot, with water added from a water pump. Finally, water carrying the starch is passed through sieves and channeled into a container (Figure 3). It takes 15 days to process 10 trunks. Based on observation, type 2 sago farming produces whiter starch as compared with type 1 sago farming.

Profit sharing among a sago owner, machine owner, and sago farmer is a popular method in North Luwu. Calculating the profit sharing related to sago starch production allows us to determine the profit margin accurately. In the profit-sharing agreement, the sago owner normally provides the sago trunk, while the sago machine owner supplies equipment and gets a share of the profit. For type 1 farming, the sago owner also has a rasping machine, so, the profit is one-third of the gross profit plus the cost of the sago trunk. Meanwhile, the sago farmer gets two-thirds of the gross profit. On the other hand, type 2 farming has two different methods related to profit sharing among the sago owner, machine owner, and sago farmers (three workers). The first profit sharing method (A) has four parts. In this arrangement, after subtracting the production cost and material cost from the revenue, the gross profit is divided into four parts. Therefore, the machine owner and each sago farmer receive one-quarter. The second profit-sharing method (B) has five parts. In this method, after subtracting the material cost from the revenue for the sago owner, the gross profit is divided into five parts. The machine owner gets one-fifth, and the remainder (four-fifths) is then divided by a total of three workers. Therefore, each sago farmer receives four-fifteenths of the profit. Based on our interviews, sago farmers can get more profit with method B than method A. A comparison of profit sharing between type 1 and 2 is shown in Figure 4.

3.2 *Dange* producers

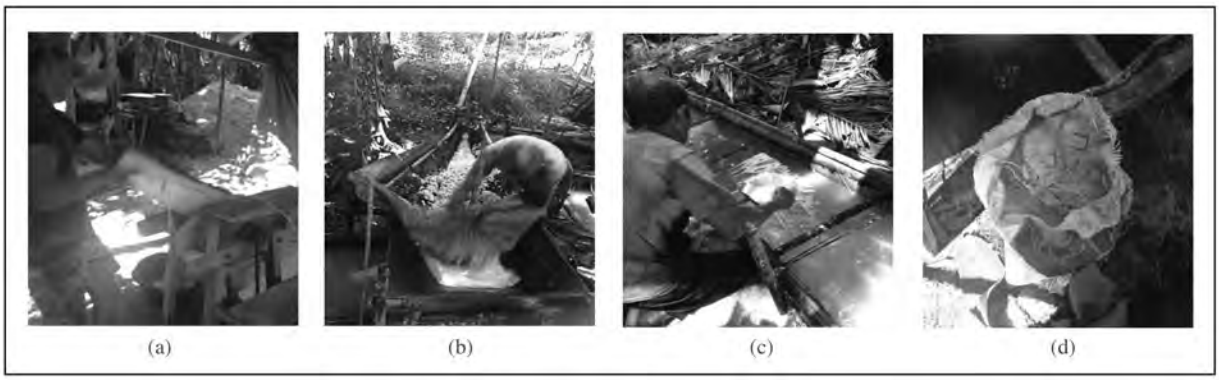

Fig 2. Sago starch extraction by type 1 sago farmer:
(a) Split log is rasped by rasping machine; (b) Sago mash is kneaded by hand;
(c) Wet sago is ready to be harvested; (d) Final product

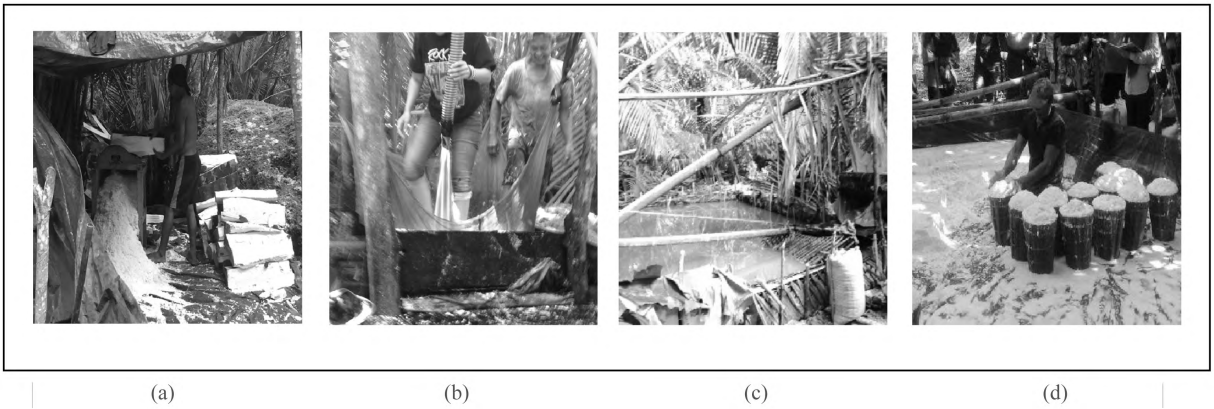

Fig 3. Sago starch extraction by type 2 sago farmers:
(a) Split log is rasped by rasping machine; (b) Sago mash is trampled by foot with water added from a water pump;
(c) Wet sago is ready to be harvested; (d) Final product

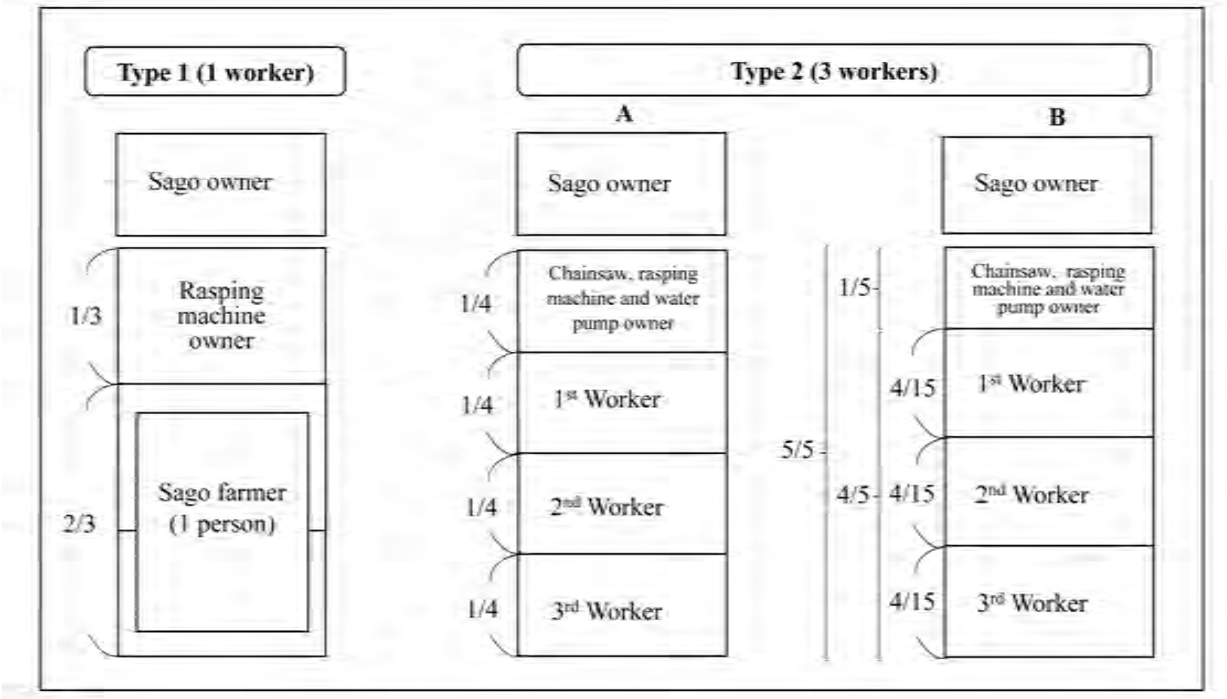

Fig 4. Comparison of profit sharing between type 1 and 2 sago farmers

Dange, or roasted sago, is commonly found in South Sulawesi. To make *dange*, producers dry wet sago in the sun and then put it through a sieve to remove foreign objects. The dried sago is then inserted into a heated clay mold (Figure 5). In the local market, sago is sold by the *pereng* (1 *pereng*: 10 pieces of *dange*). To minimize production cost, *dange* producers use sago bark to heat the clay mold. Widjandi (1979) noted that *dange* has durability, high resistance to common damaging factors during transportation and storage, and is non-hygroscopic, but swells quickly when dipped in liquid or a beverage.

3.3 Dried sago producer

As mentioned above, we found only one dried sago producer respondent in South Sulawesi. Based on interviews with sago farmers, we learned that they do not want to produce dried sago because: (1) they already get enough profit from selling wet sago and (2) production of dried sago requires much effort (drying, sieving, and packaging) but results in fewer profits.

The quality of the dried sago product that we found in the field is still far from an acceptable standard for edible sago starch. The starch is yellowish white with a distinctive odor, although the packaging is very attractive. Moreover, the producer does not have knowledge of acceptable standards for edible sago starch. Figure 6 shows a traditional method of dried sago production. The drying process is done traditionally by exposing wet sago to the sun for a period of time. Afterward, the dried starch is passed through a sieve and then stored in a sack. The dried sago is sold in plastic packaging (750 grams) and marketed to several modern markets within and beyond South Sulawesi.

3.4 Middlemen and retailers

In the traditional distribution channel for sago starch, middlemen and retailers have important positions. One of the main reasons the middlemen exist in the distribution process is to fill a gap between the producers and retailers to bring the product to consumers. In the process, from making the product to reaching the final consumer, the price of the product is marked up to cover transportation, storage, and profit. Based on our interviews, middlemen in South Sulawesi collect wet sago from local sago farmers and sell it to special retailers (Jembatan Baliase) and local markets (Figure 7).

4. Value chain mapping of sago starch in South Sulawesi

Figure 8 summarizes the value chain mapping of sago starch in South Sulawesi. A sago palm owner sells sago palm trees to types 1 and 2 sago farmers. Wet sago is derived from production by type 1 sago farmers, and they sell it directly to *dange* producers and consumers around the village. Meanwhile, type 2 sago farmers sell starch to dange producers, middlemen, and dried sago producer. Wet sago collected by a middleman is then sold to a special market in Jembatan Baliase, which is known as a sago market where people from outside South Sulawesi stop to buy wet sago.

The *dange* marketing chain starts with the wet sago produced by sago farmers, which is subsequently bought by dange producers. *Dange* is then sold to retailers and, afterward, to consumers. However, in several cases, *dange* producers sell their products directly to consumers around the village. For dried sago, the chain starts with the sago farmer, where a producer obtains wet sago, and the product is then sold in modern markets (Alfa Midi and Misi Pasaraya), souvenir shops, and outside South Sulawesi, including Surabaya, Southeast Sulawesi, and Jakarta.

4.1 Average added value of wet sago in South Sulawesi

The average added value for each commodity handled in wet sago production was calculated using Hayami's method (Table 3). The table shows that the output of the product is wet sago. The monthly

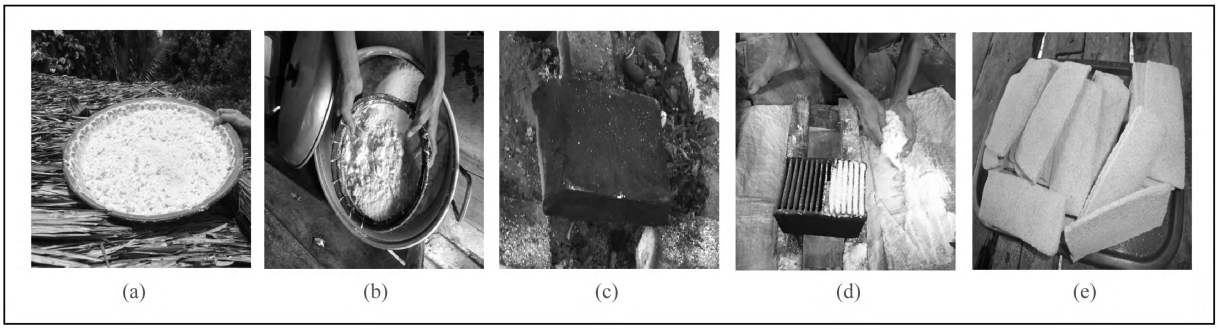

Fig 5. *Dange* production process: (a) Wet sago is dried in the sun; (b) Dried sago is passed through a sieve; (c) A clay mold is heated; (d) Dried sago is inserted into a heated clay mold; (e) The product is finished

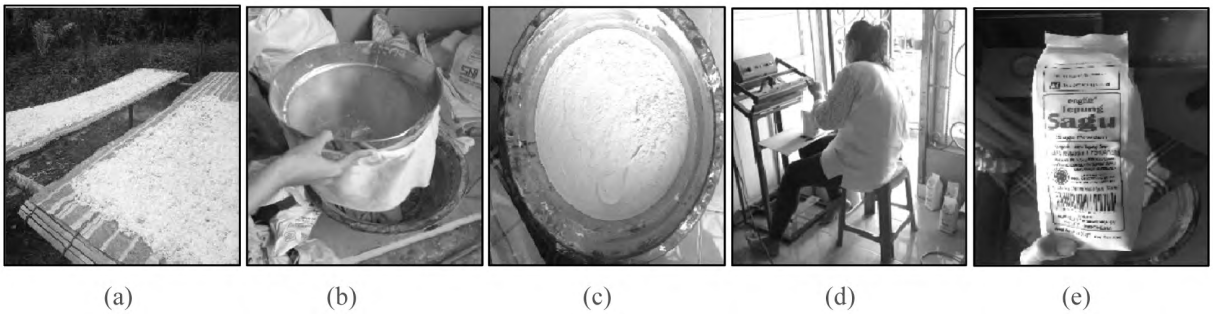

Fig 6. Traditional method of dried sago production: (a) Wet sago is dried in the sun; (b) Dried sago is passed through a sieve; (c) Dried sago is ready to be stored in a sack; (d) Packaging process; (e) The product is finished

Fig 7. (a) Sago market in Jembatan Baliase; (b) Middlemen sell sago in the local market

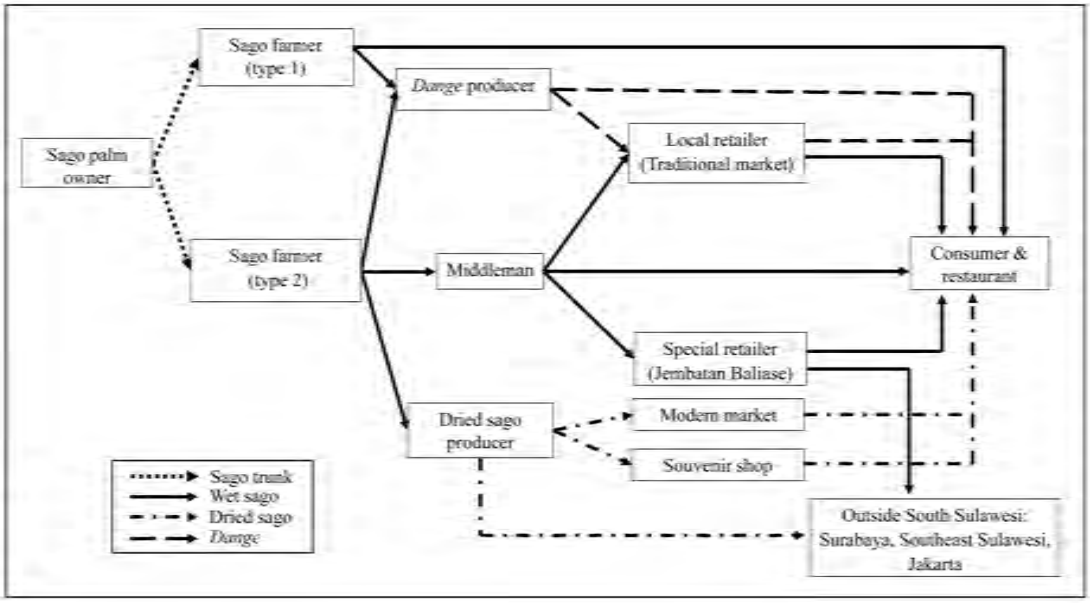

Fig 8. A value chain map of sago products in South Sulawesi

Table 3. Average added value of the wet sago chain (Rp/kg, 1 US$=Rp 13,755)

Variable	Computation	Sago farmers			Middleman + local market	Special market		
		Type 1	Type 2					
			A	B		Big	Medium	Small
Output (kg, wet sago)	A	600	4,733	4,800	7,140	6,375	6,375	6,375
Input material (kg, sago tree)	B	1,971	19,710	19,710	7,140	6,375	6,375	6,375
Conversion factor	C=A/B	0.3	0.24	0.24	1	1	1	1
Price of output (Rp/kg)	D	1,800	2,300	2,400	3,333	3,333	6,364	6,667
Cost of input (Rp/kg)	E	203	157	159	2,350	3,000	3,000	3,000
Cost of other inputs (Rp/kg)	F	139	131	123	167	33	364	500
(Diesel/Gasoline)		36	43	47	-	-	-	-
(Machine owner)		103	88	76	-	-	-	-
(Transportation)		-	-	-	104	-	-	-
(Packaging)		-			63	33	364	500
Value of output (Rp/kg)	G=C*D	548	552	584	3,333	3,333	6,364	6,667
Added value (Rp/kg)	H=G-E-F	206	264	303	816	300	3,000	3,167
Ratio of added value to total value (%)	I=H/G*100	37.7	47.7	51.9	24.5	9	47.1	48

production costs incurred by sago farmers can be divided into the main input material, which is sago trees, and other inputs, such as diesel/gasoline and machine rental. Meanwhile, for middlemen and retailers, transportation and packaging are the main expenses. It should be noted that the chain could be handled by one person who acts as a middleman and retailer, which influences the amount of added value generated by such a person that occurs in the distribution of wet sago.

To calculate the input material, the results of research by Yamamoto et al. (2016) are used, in which one sago tree is converted to 985.5 kg. The price of a sago tree varies from Rp 150,000 to Rp 200,000. The price of wet sago from sago farmer type 1 is Rp 1,800/kg, which is relatively lower than that from type 2 at Rp 2,300/kg–2,400/kg, due to the quality of the starch. At the end of the chain, the wet sago is sold either by middlemen in local markets or to the special market (Jembatan Baliase). Middlemen sell the wet sago for Rp 50,000 by big *tumang*, which contains around 15 kg of wet sago. At Jembatan Baliase, retailers sell wet sago in three sizes of *tumang*: big (15 kg, Rp 50,000), medium (5.5 kg, Rp 35,000), and small (1.5 kg, Rp 10,000). Based on our interviews with retailers, we found that they earn higher profits by selling wet sago in the smallest sized *tumang* rather than the bigger ones.

The conversion factor for type 1 sago farmers is 0.3, and for type 2 (A and B) it is 0.24, which results in the value of wet sago produced from 1 kg of sago tree being about Rp 548 (type 1), Rp 552 (type 2A), and Rp 584 (type 2B). Meanwhile, the conversion factor for middlemen and retailers is 1, which results in the value of output for wet sago being about Rp 3,333/big *tumang*. However, the value of output for wet sago is notably higher for a medium *tumang* (Rp 6,364) and a small *tumang* (Rp 6,667).

The added value for wet sago is calculated by subtracting the cost of the sago tree, diesel/gasoline, and machine rental from the value of the output. The result showed the added value amounts to Rp 206/kg (37.7%) for type 1, Rp 264/kg (47.7%) for type 2A, and Rp 303 (51.9%) for type 2B, whereas the added value amounts to Rp 816/kg (24.5%) for middlemen and Rp 300/kg (9%) for retailers. Assuming that all big *tumang* are divided into medium and small *tumang*, the added value amounts to Rp 3000/kg (47.1%) and Rp 3,167/kg (48%), respectively. This result confirms retailers' belief that the smaller the *tumang*, the bigger the profit.

4.2 Average added value of *dange* in South Sulawesi

Table 4. Average added value of the *dange* chain (Rp/kg, 1 US$=Rp 13,755)

Variable	Computation	Sago farmer		*Dange* producer		Retailer (local market)
		Type 1	Type 2 (average)	Type 1	Type 2	
Output (kg)	A	600	4,767	75	150	150
Input material (kg)	B	1,971	19,710	75	150	150
Conversion factor	C=A/B	0.3	0.24	1	1	1
Price of output (Rp/kg)	D	1,800	2,350	5,000	5,000	8,333
Cost of input (Rp/kg)	E	203	158	1,800	2,350	5,000
Cost of other inputs (Rp/kg)	F	139	127	1,744	872	50
(Diesel/Gasoline)		36	45	-	-	-
(Machine owner)		103	82	-	-	-
(Transportation)		-	-	1,067	533	-
(Clay mold)		-	-	444	222	-
(Packaging)		-	-	233	117	50
Value of output (Rp/kg)	G=C*D	548	568	5,000	5,000	8,333
Added value (Rp/kg)	H=G_E_F	206	283	1,456	1,778	3,283
Ratio of added value to total value (%)	I=H/G*100	37.7	50	29.1	35.6	39.4

The production cost of processing of *dange* using Hayami's method is summarized in Table 4. *Dange* producers mostly purchase wet sago from type 2 sago farmers. However, in the field, there are special cases in which the producers buy wet sago from type 1 farmers. In this situation, the producer can use only 50% of type 1 starch because of its color and then mix it with starch from type 2.

As mentioned in Section 4.1, the output of product for sago farmers is wet sago, and the main input is sago trees. Meanwhile, the output for *dange* producers is *dange*, and the main input is wet sago that is purchased from sago farmers. For retailers, the output and input of the product are *dange*. Based on our interviews, 1 kg of wet sago is equal to 5 *pereng* (50 pieces of *dange*). *Dange* is then sold by the producer for around Rp 1,000/*pereng* to retailers. Retailers at the local market then sell *dange* at Rp 1,667/*pereng* to consumers.

The conversion factors for sago farmer types 1 and 2 (A and B) as shown in Table 3 are 0.3 and 0.24, respectively. The conversion factor for *dange* producers and retailers is 1, which results in the value of output for *dange* being about Rp 5,000/kg. In addition, the added value for *dange* producers who use wet sago from type 1 sago farmers is Rp 1,456/kg (29.1%) and, for using wet sago from type 2 farmers, is Rp 1,778 (35.6%). Meanwhile, the added value for retailers is Rp 3,283 (39.4%), which is remarkably high because retailers do not need to pay for transportation and storage. The survey also indicated that there were no explicit or implicit contracts between retailers and *dange* producers. Retailers coordinate price offers, and *dange* producers do not know the price at which retailers resell their product to consumers.

4.3 Average added value of dried sago in South Sulawesi

The production structures for the processing of dried sago are summarized in Table 5. The dried sago marketing chain in South Sulawesi involves retailers, such as modern markets and those outside South Sulawesi. The product output of sago farmers is wet sago, and the main input is sago trees. Meanwhile, for dried sago producer, the output is dried sago, and the main input is wet sago. For retailers, the output and the input of the product are dried sago.

A dried sago product is sold for around Rp 7,650/pack (1 pack is 750 grams) by the producer. The conversion factor for dried sago producer is 0.7, which results in the value of dried starch produced from 1 kg of sago tree being about Rp 7,140/kg. Meanwhile, the conversion factor for retailers is 1,

Table 5. Average added value of the dried sago chain (Rp/kg, 1 US$=Rp 13,755)

Variable	Computation	Sago farmer type 2 (average)	Dried sago producer	Modern market	Souvenir shop
Output (kg)	A	4,767	1,500	1,500	1,500
Input material (kg)	B	19,710	2,143	1,500	1,500
Labor input (man-day)	C	-	6	48	60
Conversion factor	D=A/B	0.24	0.7	1	1
Labor coefficient	E=C/B		0.0028	0.032	0.04
Price of output (Rp/kg)	F	2,350	10,200	19,333	20,000
Labor rate (Rp/man-day)	G	-	375,000	4,000	5,000
Cost of input (Rp/kg)	H	158	2,350	10,200	10,200
Cost of other inputs (Rp/kg)	I	127	355	-	-
(Diesel/Gasoline)		45	-	-	-
(Machine owner)		82	-	-	-
(Transportation)		-	200	-	-
(Packaging)		-	140	-	-
(Depreciation cost of equipment)		-	15	-	-
Value of output (Rp/kg)	J=D*F	568	7,140	19,333	20,000
Added value (Rp/kg)	K=J-H-I	283	4,434	9,133	9,800
Ratio of added value to total value (%)	L=K/J*100	50	62.1	47.2	49
Labor income (Rp)	M=E*G	-	1,050	128	200
Margin (Rp)	N=K-M	-	3,384	9,005	9,600

which results in the value of dried sago being about Rp 14,500/pack at modern markets and Rp 15,000/pack at souvenir shops. Indeed, the added value for retailers is highest, with a value of Rp 9,133/kg (47.2%), for modern markets and Rp 9,800/kg (49%) for souvenir shops. In addition, the net margin is Rp 3,384/kg for sago farmers, Rp 9,005/kg for modern markets, and Rp 9,600/kg for souvenir shops. Based on our interview with the dried sago producer, there was an explicit contract between the retailer and the producer. The producer and retailers also openly discuss and coordinate price offers together. In contrast to *dange* producers, the producer knows the price at which retailers resell their product to consumers.

5. Conclusion

This study revealed that dried sago production is the most profitable and has the highest significant value-adding process as compared with the production of wet sago and *dange*. This finding contradicts sago farmers' belief that wet sago is more profitable. Because sago starch forms a major part of the household diet and livelihood for most households in the selected villages, intervention targeted at improving the sago starch processing sector is likely to have a significant effect on villagers. We recommend that sago farmers use good manufacturing practices (GMP) to produce sago starch with higher quality. In addition, developing a refining sector is necessary to increase smallholder productivity and income. Future research is needed to focus on a refining sector model and marketing system to help smallholders seize opportunities for commercialization and income diversification from sago processing.

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