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Revitalizing Indonesia's Sugar Industry: Unveiling the Potential of Sago as a Catalyst for National Sugar Self Sufficiency in the Future

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Sago, the other source of sugar production need to be pursued in Indonesia, as Indonesia is highly dependent on sugar cane. This study aimed to analyze the production of liquid sugar based on sago by enzymatic method. The characteristics of liquid sugar made from sago has met with the standard provisions of Indonesian National Standard (SNI 01-2978992) except for the parameter of color. However, the color of sago liquid sugar is acceptable to consumers and market. The liquid sugar produced from sago could reach 0.6 to 0.8 liters per kg. If the sago is obtained from around 50,000 hectares of sago plantations and converted into liquid sugar, then around 600,000 kiloliters of sugar will be produced, or equivalent to 27% of the total national sugar production. The feasibility study showed that the sago liquid sugar business was profitable, which might be seen from the BCR value of 1.16, NPV Rp 58,754,955.64, PBP of 2 years 11 months, and IRR of 34.73%. Even though sago has a great potential, but the development still faces various problems such as unproper sago cultivation, difficulty to access sago land, limited mastery of farmer technology, and unestablished farmer institutions.
Keywords: Characteristic, production, National standard, liquid sugar, sago, land access, farmer technology, farmer institutions.

INTRODUCTION

Sugar self-sufficiency is one of the government's targets to be accomplished in recent decades. However, this has not yet been achieved. The average national production in the last 5 years was around 2.2 million tons per year. In 2022 national production of sugar was only 2.35 million tons. Nonetheless the demand of sugar is 6 million tons per year both for consumption and industrial needs. Several problems faced by the government to achieve sugar self-sufficiency are the low efficiency of sugar factories, unproductive of new sugarcane plantation, and the lack of synergy among ministries and institutions totaling around 18 institutions. The Ministry of Agriculture contributed around 20% (Kemenperin, 2022; Subiyakto, 2016).

National sugar production is relying on sugar cane commodities, where this business has been running since the colonial era (Saputra, 2020; Knight, 2018). Sugar in the Indonesian market is divided into White Crystal Sugar (WCS) and Refined Crystal Sugar (RCS). Efforts to achieve self-sufficiency in sugar that focus on only one commodity namely sugar cane which should be reviewed with various considerations. Firstly, the low competitiveness of people's sugarcane farming. It resulted in low profits and less competitive compared to other commodities such as corn, rice, onion or other commodities. This made farmers are not interested. Secondly, the cost of domestic sugar production is twice as high as the price of imported sugar. It means that the productivity and efficiency of sugar cane production in Indonesia is poor (Wahyudi, 2021; Dianpratiwi *et al.*, 2018; *Soraya et al.*, 2019). Furthermore, the investment to build a sugar factory is costly. According to Sabil (2017), one sugar industry unit with a capacity of 10,000 TCD or 120,000 tons of sugar per year requires IDR 1.5-2 trillion both on-farm and off-farm. The sugar industry unit starts to produce after 4-5 years and reaches a break-even point after 8-10 years.

In this regard, it is necessary to have a new roadmap to achieve sugar self-sufficiency. This is not only depending on one type of commodity but also maximizing the potential of other sugar-producing plants such as sago.

Sago is one of the potential sugar-producing plants which is expected to be an alternative in achieving national sugar self-

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sufficiency. This is because sago palms could produce abundance of starch, ranging from 25-40 tons per ha per year. Moreover, sago plants grow widely in Indonesia and is the largest sago area in the world (Bintoro, 2016; Syakir, 2015; Flach, 1997).

This paper aimed to review the prospect of sago plants to achieve Indonesian national self-sufficiency in sugar, which is expected to be a reference for future policy making.

***The Indonesian National Sugar Dynamics*: The history of the Indonesian sugar industry began in the colonial era in the 19th century. At that time, the production was concentrated on the island of Java. However, the increasing population and demand dynamics, sugarcane development was also carried out outside Java, such as in Lampung, South Sumatra, North Sulawesi, South Sulawesi, and Gorontalo which were built during the New Order government (Basuki, 2018).

Until 2020, the sugarcane plantation area was around 447,311 ha spread across various regions in Java Island, Sumatra Island, Sulawesi Island and Nusa Tenggara. The development of acreage and national sugarcane production is presented in Table 1.

Table 1. Land area and production of sugar cane in Indonesia, 2010 – 2020.

Year	Land area (ha)	Growth (%)	Production (ton)	Growth (%)
2010	432,715		2,290,116	
2011	450,833	0.042	2,267,887	(0.010)
2012	449,148	(0.004)	2,591,687	0.143
2013	466,641	0.039	2,551,027	(0.016)
2014	477,123	0.022	2,579,173	0.011
2015	445,650	(0.066)	2,497,998	(0.031)
2016	440,732	(0.011)	2,204,619	(0.117)
2017	425,618	(0.034)	2,121,671	(0.038)
2018	429,959	0.010	2,170,947	0.023
2019	443,569	0.032	2,258,134	0.040
2020	458,432	0.034	2,416,847	0.070
Mean	447,311	0.006	2,359,101	0.008

Source: Indonesian Statistics Bureau, 2020
Description: numbers in brackets indicate negative values (-)

Table 1 shows that the development of the land area and sugarcane production nationally is fluctuating and tends to decrease. This phenomenon came from various factors such as from the sugarcane plant itself (including the lack of competitiveness of sugarcane compared to other commodities), low productivity, and sugarcane yield. The yield of sugarcane in Indonesia is less than 9%, while in some countries the yield could reach 14%. Another factor is the availability of suitable land that could not support sugar cane production. The next factor is the lack of supporting policies such as sugar import policies that suppress domestic sugar production. All of them contribute to the decline in sugarcane production (Soetopo, 2014; Dianpratiwi *et al.*, 2018; Khuluq and Mulyaningsih, 2016; Zhao *et al.*, 2018).

A study conducted by Wahyudi (2021) concluded that the sugar demand in Indonesia increased 3.4% per year (2015-2019) both white crystal sugar and rafination cristal sugar. On the other hand, the performance of sugar production in Indonesia decreased 2.2 % per year from 2.50 million tons in 2015 to 2.23 million tons in 2019. If further elaborated, the decline was due to a decrease in sugar production in Java which could not be compensated by an increase in sugar production outside Java. The main cause of the decline in sugar production in Java was downturn in sugarcane area from 230 thousand ha in 2015 to 201 thousand ha in 2019 with falling-off productivity (-0.2% per year), despite it was fluctuating (4.9-5.6 tons/ha of granulated sugar) with an average of 5.2 tons/ha. Besides, the average productivity level is lower than the potential productivity of dry land sugar accounted for more than 8 tons/ha (Rahmanto, 2018; Khuluq and Mulyaningsih, 2016) and compared to productivity in the previous five-year period of 2010-2014 which was 5.4 tons/ha.

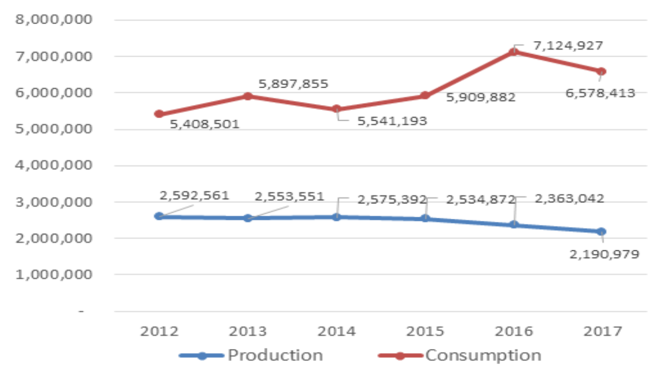

Figure 1. Indonesians National sugar production and consumption 2012 – 2017 (Rachmadhan *et al.*, 2020).

The gap between domestic sugar production and consumption has forced the government to import sugar (Sutanto and Muljaningsih, 2022), resulted in an increase trend in the last 5 years, as shown in Table 2.

Table 2. Volume and value of Indonesian sugar imports.

Year	Volume (000 kg)	Growth (%)	Value (000 $US)	Growth (%)
2015	3 375 010.4		1 256 038.0	
2016	4 761 885.4	0.411	2 090 125.5	0.664
2017	4 484 099.4	(0.058)	2 074 212.6	(0.008)
2018	5 028 853.9	0.121	1 796 221.9	(0.134)
2019	4 090 053.3	(0.187)	1 365 918.5	(0.240)
2020	5 539 678.4	0.354	1 935 927.6	0.417
Mean	4,546,596.800	0.128	1,753,074.017	0.140

Source: Badan Pusat Statistik, 2020
Description: numbers in brackets indicate negative values (-)

Table 2 shows that the volume of sugar imports significantly increased. This is inseparable from the development of the population which triggers an increase in sugar demand both for consumption and industry. In addition, domestic sugar production was unstable.

***The Dynamic of Sago*:** Sago (Metroxylon sagu Rottb.) is important and the largest starch-producing crop. Sago is known as the "starch crop of the 21st century". Sago can be used as food, bioethanol, environmentally friendly plastic, pharmaceutical and sweetener and as a source of carbohydrate with low glycemic index which is suitable for diabetics. Sago accumulates carbohydrates in the form of starch in the trunk. This begin to form starch at the age of 4-5 years after planting, and can be harvested after 8-12 years. The production of dry starch in one trunk could reach 116.69 - 372.89 kg. The potential of dry starch production is 15-40 ton / ha / year. This production is much higher than that of food commodities such as rice (15 – 20 t/ha/year), maize (20 – 25 t/ha/year), and cassava with a production range of around 25 – 30 tons/ha/year (Bintoro *et al.,* 2010; Toyoda, 2018; Bantacut, 2014; Bukhari *et al.,* 2017; Utami *et al.,* 2014; Oladzadabbasabadi *et al.,* 2017; Tjokrokusumo, 2018).

Considering the large starch production capacity, sago has a potential to become the world's food and energy of hope in the future. This plant grows well in freshwater swamps, peat swamps, watersheds, surrounding water sources, or swamp forests. Sago plants have high adaptability to marginal lands which is not suitable for any food and plantation crops (Flach, 1983; Singhal *et al.,* 2007; Bintoro, 2016; Syakir, 2009; Dewi *et al.,* 2016; Du *et al.,* 2020; Yana *et al.,* 2022).

Indonesia has the largest sago plantation in the world, covering an area of 5.5 million ha (Bintoro *et al.,* 2016). The majority sago forests are located in Papua Island, as well as several parts of Indonesia, namely Sumatra Island, Sulawesi Island, and Maluku Island. Most of these plants are used as a staple food (Pratama *et al.,* 2018; Ahmad *et al.,* 2016).

In Indonesia, there are two kind species of sago. They are thorny sago (Metroxylon rumphii Mart.) and thornless sago beka (Metroxylon sago Rottb.). The thornless sago beka has more superiority compared to the thorny sago. In general, sago plants grow wild, but some are freely planted by farmers even the spacing and layout do not meet agronomic requirements. Usually, sago grows in swampy areas with fresh water or peat swamp areas and in areas along streams, around water sources, or in swamp forests where the salt content is not too high. Sago is also able to grow in mineral soils, in freshwater swamps with more clay content of 70% and 30% organic matter. The best growth of sago is on yellow-brown or black clay with high organic matter content (Bintoro, 2008). The productivity of the sago plant depends on habitat, cultivation techniques, and plant maintenance (Bintoro *et al.,* 2010). Sago plants reach commercial age at 9 -12 years (Singhal *et al.,* 2007; Rostitawati *et al.,* 2014).

In terms of land use aspect, sago uses the lowest area to produce. One ton of sago flour is produced from 0.05/ ha, while 1 ton of rice is produced from 0.17 ha. Likewise with palm oil that produce one ton CPO need 0.24 ha. The productivity of sago plant was calculated as around three to four times of rice, corn or wheat. Compared to cassava, the productivity of sago is about 17 times higher. Therefore, sago is the highest yielding starchy crops in the world. Sago starch is not only used as food, but also widely used as a raw material in the cosmetics, food, paper, and plastic industries. In short, in this age of environmental and economic concern, sago is the pre-eminent crop for sustainable and profitable agriculture (Azmi *et al.,* 2017; Tjokrokusumo, 2018; Singhal *et al.,* 2007; Flach, 1997; Karim *et al.,* 2008; Zhu *et al.,* 2019).

The advantages of developing sago based on agronomic aspects are: (a) it can grow in swamps and peatlands which generally any plant is unable to grow, (b) it is tolerant to low pH, and high concentrations of Al, Fe, and Mn, (c) can be harvested at any time, after reaching the age of 8 to 11 years, (d) able to be harvested continuously without renewing the planting because of many tillers production, (e) could produce high starch, and (f) does not require intensive maintenance like other crops and vegetables. Sago is the only commodity that does not use additional fertilizers, pesticides, herbicides, and other ameliorants in the nursery and plantation stages (Tjokrokusumo, 2018; Bintoro *et al.,* 2018: Yamamoto, 2018)

Sago crop is Indonesia's future food crop. This is due to several things including (1) Prospective: the production is 200 – 400 kg/plant. More than 50% of the world's sago area is in Indonesia, where 90% is in Papua.; (2) Sago has multi-functions, as organic products, functional products, and gluten-free products; (3) Sago is one of the crops that guarantee a food sovereignty; (4) Sago conserves water/soil natural resources, and reduce global warming; (5) The utilize of sago is a preservation of the local wisdom value and (6) Sago can be used for pro-people policies, job creation, environmental conservation, and local human resource development (Bantacut, 2011; Pratama *et al.,* 2022; Bintoro, 2014; Abidin and Musadar, 2018).

Sago is a Source of Sugar: Another benefit of sago is its potential value as a source of sweetener (sugar). This might be one of the answers to the government's efforts to achieve national sugar self-sufficiency which was declared in 2019 (Kementan, 2016). Sago starch can be processed into liquid sugar through a hydrolysis process using acids or enzymes. Linggang *et al.* (2012) took advantage of the α-Glocosidase enzyme from aspergillus for making liquid sugar from sago pulp. Kumoro *et al.* (2008) used the glucoamylase enzyme from Aspergillus niger. Budiyanto (2015) utilized α-amylase and β-glucosidase enzymes in the process of composing liquid sugar from sago flour. The process of hydrolysis of starch into glucose molecules can be seen in Fig. 2.

$$\underset{\text{Starch}}{(C_6H_{10}O_5)_n + {}_nH_2O} \xrightarrow{\text{Enzym}} \underset{\text{Glukosa}}{(C_6H_{12}O_6)_n}$$

Figure 2. The process of starch hydrolysis become liquid sugar (Azmi *et al.*, 2017)

The process of making liquid sugar which refer to Budiyanto (2019) is shown in Fig. 3.

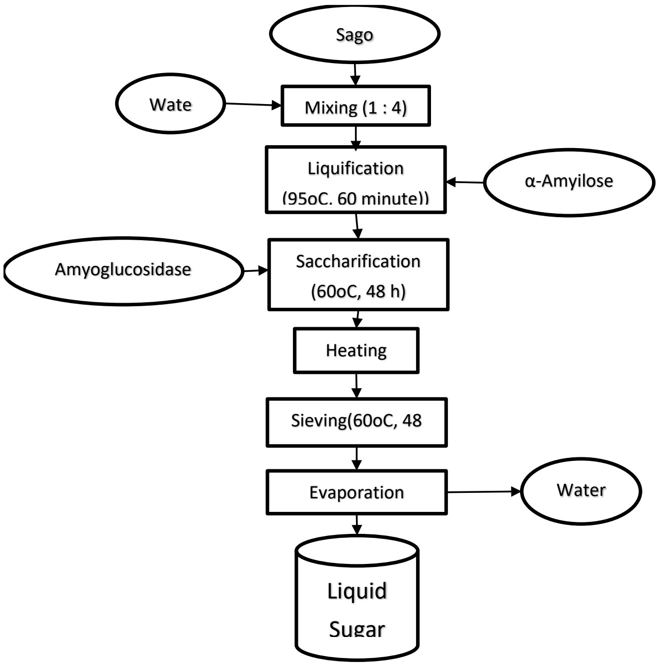

Figure 3. The flowchart of sago-starch liquid sugar production (Budiyanto, 2019).

Bujang (2015) stated that the hydrolysis of sago starch into sugar produced a 100% recovery, containing 94% glucose, 3% maltose and other impurities. Sweetness analysis revealed that sago sugar is as sweet as 50% glucose, but brown sago sugar is preferred over white sago sugar. It is because brown sago sugar contains antioxidants as much as 300 mg/kg of sugar based on the total phenolic content (TPC). Some residual TPC can be detected even after refining brown sugar. Sago sugar can also be obtained through enzymatic hydrolysis from physically processed of sago pulp, that produced large amounts of sugar (70% w/w). This implies that sago palms have enormous potential to be adopted as a new source of sugar to replace cane sugar.

The use of sago as a substance of liquid sugar has been carried out in several regions in Indonesia including West Java, Riau, North Sulawesi, South Kalimantan, Papua, West Papua, and Southeast Sulawesi (Fridayani, 2006; Budiyanto *et al.*, 2019). Furthermore, (Budiyanto *et al.* 2019; Pratama *et al.*, 2022; Widiarto *et al.*, 2017) reported that the optimum condition of liquid sugar production was obtained by using the starch water ratio of 1 : 4 with α-amylase (1.2 ml kg-1 starch) and amyloglucosidase (1.2 ml kg-1 starch). The physical characteristics of sago liquid sugar are 60^o Brix, sweet taste, typical sweet aroma of sugar, and reddish-yellow color. Furthermore, Rika *et al.* (2020) stated that the characteristic of liquid sugar has met SNI 01-2978-1992 (SNI for liquid sugar from cassava, because SNI for liquid sugar from sago is not available), except for the color parameter, which is yellowish (Tabel 1). However, this result is better than the results of similar study conducted by Murtias *et al.* (2016) who stated that liquid sugar from sago starch from Southeast Sulawesi is reddish yellow. Regarding the reddish yellow color of sago liquid sugar, Abidin (2018) stated that based on the organoleptic test, the reddish yellow color is acceptable to consumers and market.

Table 3. The characteristics of liquid sugar made from sago based on SNI 01-2978-1992.

No.	Factor measured	Unit	Recommended range (SNI 01-2978-1992)	Level found
1	Physical aspect			
	• Smell		Odorless	Odorless
	• Taste		Sweet	Sweet
	• Color		Colorless	Yellowish
2	Moisture content	% b/b	Max 20	19.16
2	Ash	% b/b	Max 1	0.85
3	Reducing sugar is calculated as D-glucosa	% b/b	Min 30	60.4
4	Starch		None	none
5	Metal contaminants			
	• Lead	Ppm	Max 1	-
	• Copper	Ppm	Max 10	1.14
	• Zinc	Ppm	Max 25	2.59
7	Arsenic	Ppm	Max 0,5	-
8	Microbial contaminants			
	• Total plate figures	Colony/g	Max 5 x 102	3.5 x 101
	• Coliform bacteria	APM/g	Max 20	-
	• E. Coli	APM/g	Less than 3	-
	• Mold	Colony/g	Max 50	-
	• Yeast	Colony/g	Max 50	-

Source: Rika *et al.*, 2020

Financial analysis based on the prevailing price in ten years showed that the processing of sago starch into liquid sugar product by using enzymatic hydrolysis method is viable and profitable as shown by BCR of 1.16, NPV of Rp 58,754,955.64, PBP in 2 years 11 months, and IRR of 34.73%. (Dewi *et al.*, 2019)

The potential of liquid sugar production from sago flour is quite large, ranging from 0.8 – 1 liter per kg of sago flour (Syakir 2015; Bintoro 2014; Budiyanto, 2016). This depends on the quality and type of sago flour used. Based on these If the sago is obtained from around 50,000 hectares of sago plantations, and converted into liquid sugar resulted in about 600,000 kiloliters of liquid sugar, or equivalent to 27% of the total national sugar production.

***Challenges and Prospects*:** Some of the challenges in developing sago as liquid sugar in the future are:

1. Sago has not been cultivated properly. One of the challenges faced in the development of sago as a liquid sugar is how to maximize the business of sago cultivation to a full business. This is because most of the existing sago land is still sago forest. The application of technical cultivation of sago is still required to obtain good growth and production, even sago palms could grow in marginal conditions. There is an assumption in the community that sago does not require good cultivation like other crops because sago could produce well even without optimal crop cultivation practices (Abidin, 2018)
2. The availability of enzymes locally. Enzymes play a vital role in the process of making liquid sugar from sago flour. Therefore, the provision of enzymes locally becomes crucial. Ramdhan *et al.* (2021) reported that enzymes could be gained from various sources such as plants, animals and microorganisms. The use of enzymes from microorganisms has several advantages including: easier isolation, simpler than enzymes derived from plants and animals and can be well controlled in the manufacturing process. Enzyme manufacturing technology is relatively complicated if it is handed over to the wide community, therefore the involvement of government in supporting the provision of this important part in the liquid sugar production process is necessary. This is to ensure the availability of a wide supply of enzymes at an affordable price at the producer level. Currently, the availability of enzymes is still limited and produced by the private sector. However, its availability locally is often an obstacle.
3. Determination of the basic price of liquid sugar. Determination of the liquid sugar basic price is vital to provide a certainty for producers in producing liquid sugar from sago. The determination of the basic price is also a kind of protection and partisanship to encourage the production of liquid sugar nationally. So far, the determination of the basic price is only for rice commodities, while prices for other national strategic commodities (rice and corn) are still left to the market freely. Mantau and Bahtiar (2010) stated that pricing policies, especially non-rice, need attention. The determination of the basic price of non-rice food might give encouragement to producers to produce other commodities so that food production would increase, food security might strengthen, and price certainty would be guaranteed. Specifically, Daryanto (2008) reported that the determination of the basic price by the government was primarily aimed to prevent traders from playing up price, which not only confine for farmers as producers but also for society as consumers. This will not only have an impact on the level of farmers' welfare but it will be broader and can threaten food security. Food price instability causes a decline in people's purchasing power which triggered a food crisis.
4. Market guarantee. Market guarantees is a crucial aspect in the production of agricultural commodities, especially food product. Above all, sago liquid sugar which is a "new product" need market guarantees that will be a trigger for producers to increase the production. Currently, market guarantees for food products are only for strategic products such as rice, corn, soybeans, and sugar, in particular domestic crystal sugar. Nonetheless there is no guarantee on prices and markets for liquid sugar products yet. This is the reason for the low interest of producers to produce liquid sugar, especially sugar made from sources other than sugarcane. To support market certainty for this product, building a linkage between liquid sugar producers and users (food and beverage industry) is meaningful.

The Prospect of Sago Liquid Sugar: The prospect of developing sago liquid sugar in the future is quite bright considering several things, including:

1. The area of sago in Indonesia is around 5.43 million ha or about 83.4 percent of the world's sago area. This potential is very large to be developed as a manufacturing material for sugar production. If the sago is collected from around 50,000 hectares of sago plantations and converted into liquid sugar, then around 600,000 kiloliters of sugar will be produced, or equivalent to 27% of the total national sugar production.
2. The investment value for processing sago into liquid sugar is surely much lower than that of the conventional sugar industry. The conventional sugar investment spends approximately 1.5 – 2 trillion for a production capacity of 120,000 tons of sugar per year. Meanwhile, the development of sago liquid sugar with sago as raw material can be developed on a small and medium scale which has great potential to develop further.
3. Liquid sugar is easily enriched with essential minerals and vitamins that the human body needs. Ansharullah *et al.* (2019) reported that glucose syrup made from sago starch could be increased its added value by strengthening the antioxidant and iron content derived from kelor and katuk leaf extracts. Further stated, the fortification of moringa and katuk leaf extracts had a significant effect on iron and vitamin C levels but had no significant effect on glucose levels. The content of iron (Fe) and vitamin C increased with the increase in leaf extract. This study shows that sago flour has good prospects in producing a variety of nutritious food ingredients, as well as being added value.
4. In terms of utilization, the current trend of using liquid sugar is getting higher due to its practical using. Many food industries are using liquid sugar in their production. The reason using liquid sugar are (1). It is not crystalized, (2). easier to process due to its higher solubility, (3). more

practical, and (4). more attractive appearance compared to sugar in general (Permanasari and Yulistiani, 2017). In addition, liquid sugar is a monosaccharide, that will be quickly converted into energy rather than ordinary sugar which is a disaccharide. Setiawan (2020) stated that glucose syrup had a natural taste. In ice cream products, glucose suppresses the freezing point and increase the smoothness of the texture. In processed cakes, it keeps the cake fresh and not easy to crack. Whereas in candy, more glucose can prevent microbiological damage and improve texture. Another advantage of sago liquid sugar compared to similar products from other sources of starch is its lower GI (glycemic index) content. The GI of sago was accounted for less than 55, so it is healthier to consume because of not causing fluctuations in blood sugar levels (Ahmad *et al.*, 2009)

***Conclusion*:** Sugar self-sufficiency announced by the Indonesian government in the last several decades has not been achieved so far. The roadmap for self-sufficiency in sugar that focuses on sugar cane needs to be reviewed by including and maximizing the potential of other crops to produce sugar, such as sago. Sago plants have enormous potential as a source of starch, accounted for 25-40 tons/ha/year. Sago starch can be processed into liquid sugar through an enzymatic processes. The production could reach 0.6 to 0.8 liters per kg. So, if sago harvested from around 50,000 ha, it would produce 600,000 kiloliters of sugar which is equivalent to 27% of the total national sugar production. The characteristics of the liquid sugar are 60^{o} Brix, sweet taste, no odor, reddish yellow color, no contamination of harmful elements such as Pb, Cu, Zn, As, and no microbial contamination. This liquid sugar has met Indonesia National Standard (SNI 01-2978992), except for the parameter of color. The feasibility analysis showed that the sago liquid sugar business was profitable, which had the BCR value of 1.16, NPV of Rp 58,754,955.64, Pay Back Period 2 years 11 months, and IRR of 34.73%. The challenges for developing sago liquid sugar are: (1) sago has not been cultivated properly; (2) the availability of enzymes locally; (3) determining the basic price of liquid sugar; (4) market guarantee. Furthermore, the prospect of developing liquid sugar in the future is very bright considering several things, including (1) the vast area of sago in Indonesia which reaches 5.43 million ha; (2) the investment value for making sago liquid sugar is much lower than that of sugar cane; (3) the trend of using liquid sugar continues to increase.

***Author's contribution statement*:** Zainal Abidin: conceived of the presented idea, developed the theory, performed the computations, wrote the manuscript; Bahari: calculation the economic aspect of Sago; Ansharullah & Sitti Aida Adha Taridala: investigate the technical aspect and the utilization of sago for liquid sugar. All author discussed the results and contributed to the final manuscript.

***Conflict of interest*:** The authors declare no conflict of interest.

***Ethical statement*:** This article does not contain any studies regarding human or animal.

***Availability of data and material*:** We declare that this manuscript is our work, which has not been published and is not being considered for publication elsewhere.

***Code availability*:** Not applicable.

***Consent to participate*:** All authors participated in this article.

***Consent of publication*:** All authors submitted consent to publish this article.

***SDG's Addressed*:** Zero Hunger.

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