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Improving the Cambodian Palm Sugar Industry

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Abstract

The Cambodian people have engaged in palm sugar production since ancient times and it has become a tradition of the Khmer people. Palm sugar has been considered more a commercial commodity over the past 10 years which has led to the use of innovative technology and product marketing strategies. Palm sugar has emerged as a new product that attracts many investors and exporters. In 2015 some 25 per cent (34.9 metric tons) of all types of palm sugar were sold locally, while 75 per cent (103 metric tons) was exported.

A value chain analysis is undertaken and finds that, despite making progress, the chain has encountered some challenges such as limited capital investment by producers, lack of technical skills to produce good quality products, high labour intensity and the dangers associated with climbing trees. There are some suggestions proposed for improvement to support the performance of the chain. The suggestions include improving production techniques of producers, making contracts between producer associations and exporters, taking advantage of its existing Geographical Indication status and continuing research and development of the palm sugar sector.

Key words**:** palm sugar, value chain analysis, geographical indication, contract farming

Introduction

Around 80 per cent of the Cambodian population live in rural areas and most of them depend on agricultural activities for their daily livelihood (MAFF, 2013). The agricultural sector contributed 25.3 per cent of GDP in 2017 (Index Mundi, 2017). From 2007 to 2014, the poverty rate significantly dropped from 47.8 per cent to 13.5 per cent of the population (World Bank, 2019). In terms of food, rice and fish are the basic daily foods that supply protein, while other crops also play important roles for daily life.

The sugar palm tree is a common plant in Cambodia. The government has identified the sugar palm tree as one of its national identities, among other plants and animal species, due to its important role in the daily life of rural Cambodians. The tree is considered to be multi-purpose as it provides various benefits from roots to leaves. It can be used for many purposes including stems for construction, fruit for cupcakes, dessert or soup, and the juice can be extracted as palm sugar which provides high incomes for farmers (Borin, 1996).

"Thnot" is the common name of the palm tree in the Khmer language and the scientific name is "*Borassus flabellifer*". There are two common types of palm tree from which juice can be extracted as palm sugar, namely palmyra palm and coconut palm. Cambodian famers extract palm sugar from palmyra palms (Figure 1).

Figure 1. Palm sugar tree in Cambodia

The Cambodian people have engaged in palm sugar production since ancient times and it has become a tradition of the Khmer people. The production of palm sugar has been considered more as a commercial commodity over the past 10 years which has led to the use of innovative technology and product marketing strategies. Palm sugar has emerged as a new product that attracts many investors and exporters (MoC, 2016). In addition, there are numerous features that make Cambodian palm sugar well known, including its low glycemic index, organic production, and pleasant taste. In the granulated form, its applications are similar to those of white sugar (MoC, 2016). Kampong Speu palm sugar, in particular, is renowned for its high quality and it was declared as a protected Geographical Indication (GI) product by the Cambodian government in 2010 and registered as a GI product of the European Union in April 2019 (Khmer Times, 2019).

In this paper the value chain of palm sugar is examined and some suggestions are made to improve the performance of the chain and to improve the livelihoods of the palm sugar producers.

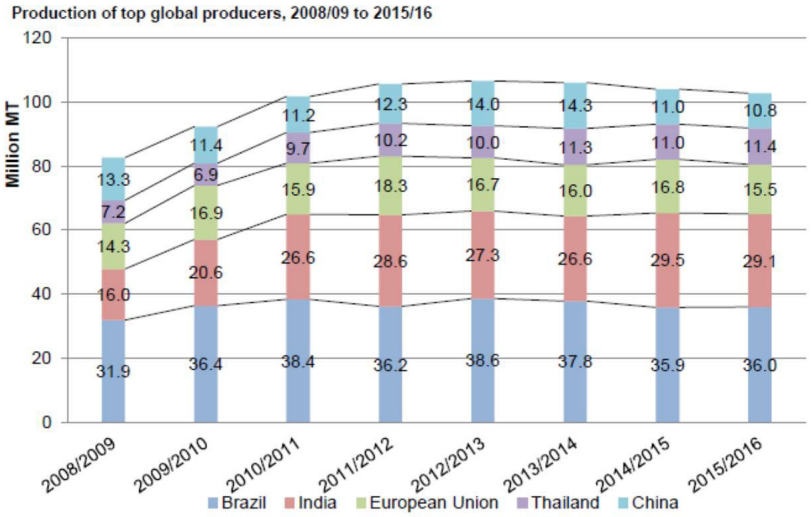
Global Sugar Trade

Sugar exists in a significant proportion of food and drinks and is commonly consumed around the world. The consumption of sugar globally was estimated at 173.4 million metric tons between 2015 and 2016, while 54 million metric tons of sugar was exported (MoC, 2016). However, the global market for palm sugar in 2017 was only 747,525 metric tons although it is expected to reach 958,512 metric tons by 2025 (Persistence Market Research, 2019). One of the reasons for this growth is concern among people over diabetes and obesity resulting from excess sugar consumption. Palm sugar has a low glycemic index of 35 versus 90 for white refined sugar.

Sugarcane and sugar beet are the two main sources of world commercial sugar. Sugarcane accounts for about 74 per cent of the global sugar market, while sugar beets accounts for nearly 25 per cent. The remaining small proportion includes sugar from palm, sorghum and the sugar maple.

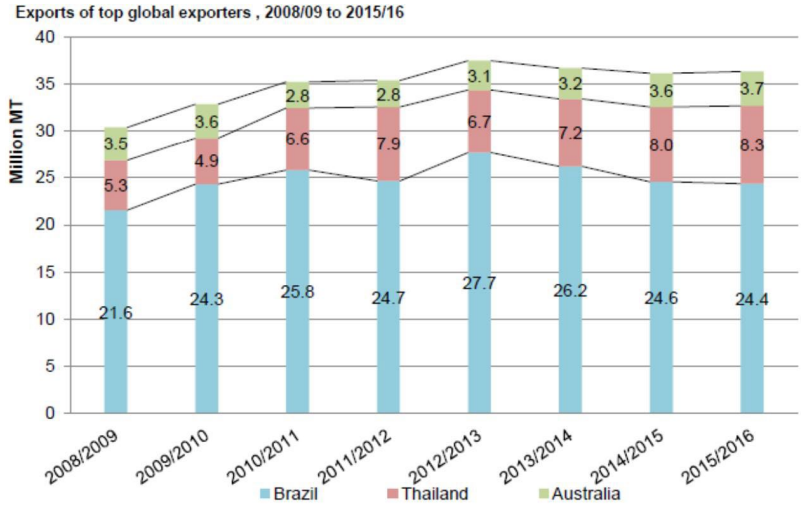
From 2008 to 2016, Brazil was the world's largest sugar producer, followed by India, the European Union, Thailand and China (Figure 2). Within the same period, Brazil was also the world's top sugar exporter, followed by Thailand and Australia (USDA, 2016) (Figure 3). According to the recent food outlook by FAO, Brazil remains the world's top exporter of sugar accounting for 34.4 per cent of sugar exports (FAO, 2019) (Figure 4).

Figure 2. Top global sugar producers



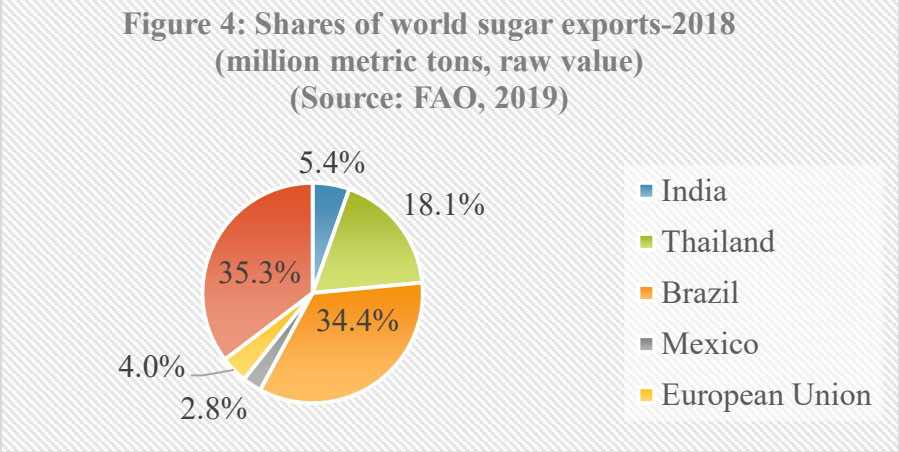
Note: Top producers have accounted for between 57 and 63 percent of global production.
Source: Foreign Agricultural Service, USDA.

Figure 3. Top global sugar exporters



Note: Top exporters have accounted for between 65 and 75 percent of global exports.
Source: Foreign Agricultural Service, USDA.

Indonesia, Ethiopia, India, Cambodia and Thailand are the major palm sugar producers, while the United States has the largest palm sugar consumption at around 500 metric tons per month (Ananda Ventures, 2017). Although palm sugar is relatively small compared to the overall sugar market, the market for sugar substitutes is growing considerably. There is an estimate that palm sugar trade globally is relatively small accounting for less than 1,000 metric tons (MoC, 2016).



Cambodia Palm Sugar Production, Potential for Trade and Market Analysis

Production

Palm sugar production in Cambodia is consumed domestically in the form of paste and is exported in the form of sugar powder. Although national palm sugar statistics do not exist as it is a new commercial commodity, it is estimated that domestic consumption accounts for about 30 metric tons, while exports accounts for about 100 metric tons (MoC, 2016). However, a rapid appraisal conducted by the Ministry of Commerce estimates that the production of palm sugar is around 14,000 metric tons in paste form. This quantity of palm sugar paste could produce 9,100 metric tons of sugar powder as the output of powder from paste is 65 per cent. Therefore, the export amount of 100 metric tons accounts for only 1 per cent of total production (MoC, 2016). It was reported recently that palm sugar was exported to 25 countries as of 2019 (Sokhorng, 2019). The major importers of Cambodia palm sugar powder are Japan, Korea, Taiwan, Germany, France and the United States. The 2014 export value was estimated to be between US$190,000 and US$290,000.

According to statistics from the Ministry of Commerce, Kampong Speu, Kampong Thom, Kampong Chhnang and Svay Rieng are the top four producing provinces in Cambodia. Kampong Speu is by far the largest, with palm sugar powder production increasing dramatically from 24,890 kg in 2013 to 53,262 kg in 2015 (Table 1).

Potential for Trade

Palm sugar has the potential to reach wider national and international markets due to the substitutability of its granulated form of sugar for white refined sugar (MoC, 2016). In 2016, 1.2 million palm trees were harvested (MoCo, 2016). Despite having no regular update of palm trees, as of 2010 there were around 3 million palm trees (Table 2). According to the Ministry of Commerce, the average productivity of a single tree is 80 kg of palm sugar powder. The production of palm sugar can be estimated at 240,000 metric tons a year. The current estimated production of 9,100 metric tons represents only 4 per cent of the potential (MoC, 2016). Therefore, the potential for export is worth US$648 million, at a palm sugar powder value of US$2.7/kg (Figure 5).

Palm Sugar Market Analysis

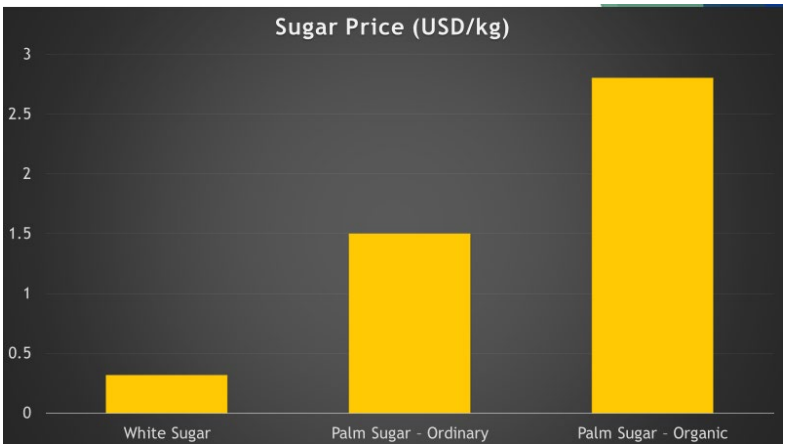
This study uses data on Kampong Speu palm sugar powder (both organic and Geographical Indication (GI) of the Ministry of Commerce) production and trade available from members of the Kampong Speu Palm Sugar Association (KSPA) as an illustration of the value chain (Figure 6).

Table 1. Sugar production by different types (kg) of the top four provinces (2013-2015)

Year	Type	Svay Rieng	Kampong Thom	Kampong Chhnang	Kampong Speu
2013	***Powder***	-	1,770	2,950	***24,890***
	Paste	10,030	39,300	19,500	76,900
	Bloc	7,200	60	-	1,200
	Syrup	-	-	-	600
	Total	**17,230**	**41,130**	**22,450**	**103,590**
2014	***Powder***	-	1,345	830	***35,548***
	Paste	10,230	36,300	22,100	71,950
	Bloc	6,400	1,200	-	1,100
	Syrup	-	-	-	600
	Total	**16,630**	**38,845**	**22,930**	**109,198**
2015	***Powder***	678	2,160	1,310	***53,262***
	Paste	11,150	34,200	20,100	47,300
	Bloc	6,200	1,600	-	1,320
	Syrup	-	-	-	750
	Total	**18,028**	**37,960**	**21,410**	**102,632**

Source: MoC (2016)

Figure 5. Price of Cambodia palm sugar



Source: Agrifood Consulting International (2016)

The price of organic powder sugar that the companies purchase from members of KSPA increased slightly from 4000Riel/kg in 2013, to 4200Riel/kg in 2014 and to 4400Riel/kg in 2015 (MoC, 2016), (where US$1 equal 4050Riel). Despite having the same price of both types of sugar (GI and organic), from 2016 KSPA will differentiate the price. They will buy product at higher price compared with GI product.

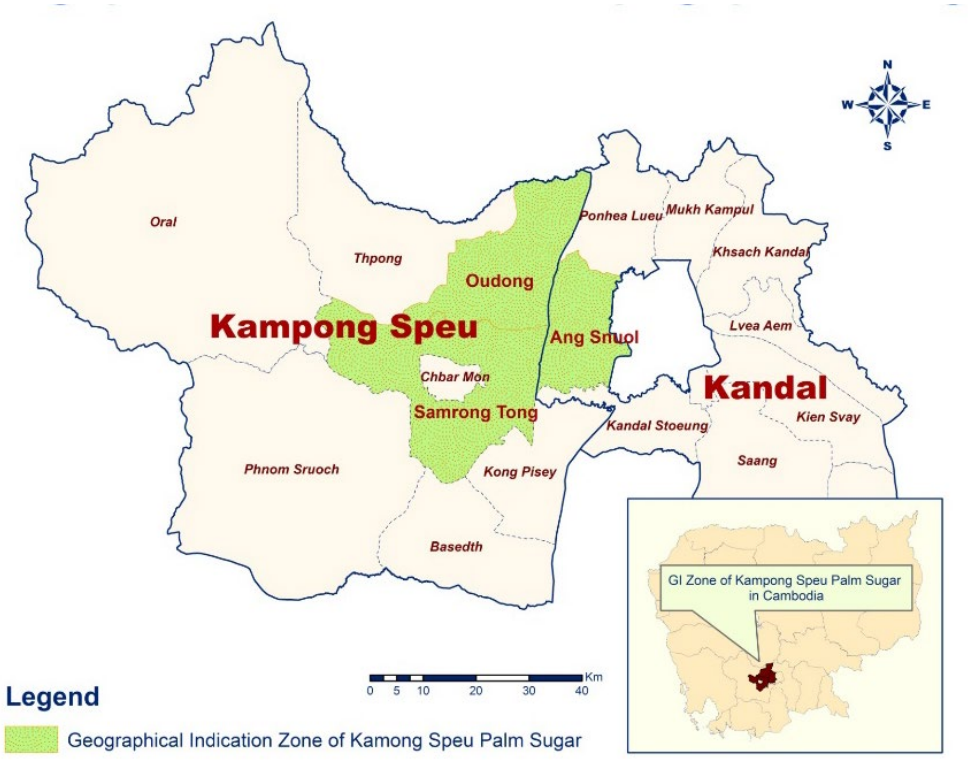
However, the price of organic palm sugar in international markets is almost double at US$2.8/kg on average, while the price of ordinary palm sugar is US$1.5/kg (Figure 7). This creates great potential for sales of Cambodia palm sugar (GI and organic) to grow. The purchasing price of GI powder is the same at US$1,250 per metric ton, while the selling price varies from US$1,375 to US$2,750 (Table 3). However, the volume of GI powder sugar exports is expected to rise in the next five years.

Table 2. Number of palm trees by province

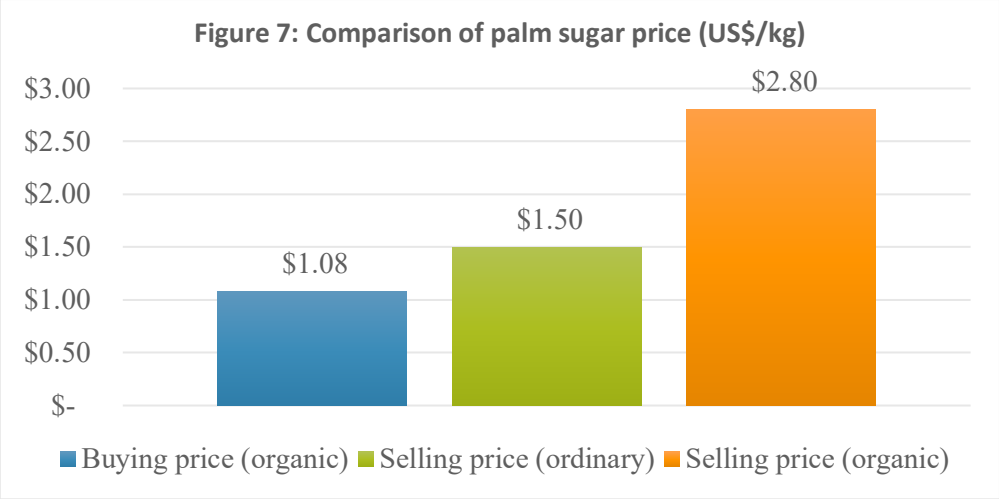
Province	2005	2010	Percentage in 2010
Banteay Meanchey	4,900.00	4,900.00	0.2 per cent
Battambang	41,282.00	41,282.00	1.4 per cent
Kampong Cham	120,455.00	120,455.00	4.0 per cent
Kampong Chhnang	***395,500.00***	***395,500.00***	***13.2 per cent***
Kampong Speu	***311,132.00***	***311,132.00***	***10.4 per cent***
Kampong Thom	***757,500.00***	***757,500.00***	***25.3 per cent***
Kampot	36,650.00	36,650.00	1.2 per cent
Kandal	257,500.00	257,500.00	8.6 per cent
Koh Kong	3,438.00	1,420.00	0.0 per cent
Kratie	42,785.00	42,785.00	1.4 per cent
Phnom Penh	2,732.00	2,732.00	0.1 per cent
Preah Vihear	7,899.00	7,899.00	0.3 per cent
Prey Veng	***348,594.00***	***348,594.00***	***11.6 per cent***
Pursat	167,654.00	167,654.00	5.6 per cent
Siem Reap	138,997.00	138,997.00	4.6 per cent
Steung Treng	14,400.00	13,000.00	0.4 per cent
Svay Rieng	135,040.00	135,040.00	4.5 per cent
Takeo	215,878.00	215,878.00	7.2 per cent
Total	**3,002,336.00**	**2,998,918.00**	**100 per cent**

Source: DPS-MAFF (2010)

Figure 6. Geographical Indication zone of Kampong Speu Palm Sugar



Source: GI project (MoC & MAFF)



Source: MoC (2016)

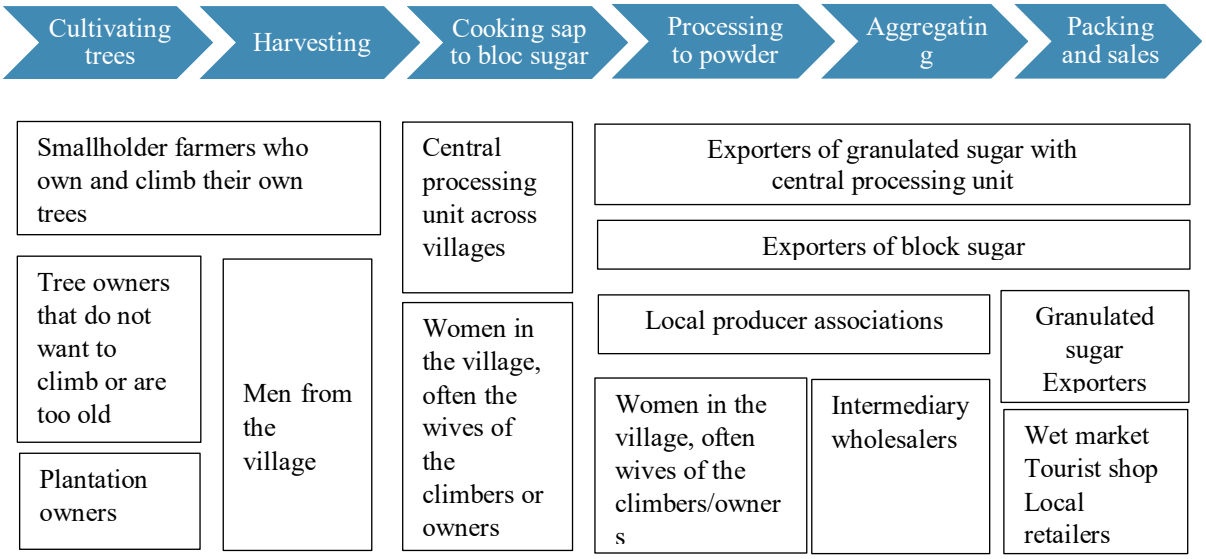
Table 3. Comparison of buying and export value

Product	Buying value (US$/T)	Exporting value (US$/T)	Gross benefits (US$/T)
GI powder[1]	1,250	1,375	125
	1,250	2,750	1,500

Source: MoC (2016)

Palm Sugar Value Chain Map and Key Actors

Figure 8. Palm sugar value chain map *Source*: Ananda Ventures (2017)



Most of the activities occur from cultivating to processing. Generally, men are involved in climbing trees and harvesting sap, while women engage in cooking and processing. In the aggregating and packaging and sales stage, different actors are involved in the chain, including exporters, local producer associations and wholesalers.

[1] Based on report from two companies (MoC, 2016).

There are a number of key actors who are directly involved in the palm sugar value chain, including producers, traders, companies, cooperatives, exporters, etc. The product reaches consumers through different channels. It can reach consumers directly from producers or through traders or through domestic markets. Companies that export can collect from traders or cooperatives.

Kampong Speu Palm Sugar Supply Chain

From producers to export markets, Kampong Speu palm sugar is delivered at five market stages, including at the village level, local market, provincial market, Phnom Penh wholesale market and Phnom Penh retail market (Figure 9) (Sereyvath et al., 2009). Producers at the village level can directly sell to consumers or collectors either within their village or at the local market, while some producers can sell to middlemen or wholesalers at the provincial market. In the case of contract producers, they can trade directly with the processing enterprise based on a contract. Collectors are at village and local markets. Some sell products to retailers, while some deliver to wholesalers at the provincial market or at the Phnom Penh market. The middlemen/wholesalers then export overseas.

Kampong Speu palm sugar is growing in popularity in international markets. The amount of powder sugar purchased in Kampong Speu increased dramatically from 33 metric tons to 133.2 metric tons in 2013 and 2015, respectively (MoC, 2016) (Figure 10). There are seven companies that have been involved in palm sugar export, namely Confirel, Kata, Sovannak, Bright Starling, CEDAC, Farmlink and Gold Palm Sugar (MoC, 2016). Some 25 per cent (34.9 metric tons) of all types of powder sugar was sold locally, while 75 per cent (103 metric tons) was exported, in 2015 (MoC, 2016). Despite the high export proportion, the volume is still very small (Figure 11).

Chain Performance Assessment

Following Aramyan et al. (2007) and Gunasekaran et al. (2004), the following criteria are used.

Efficiency

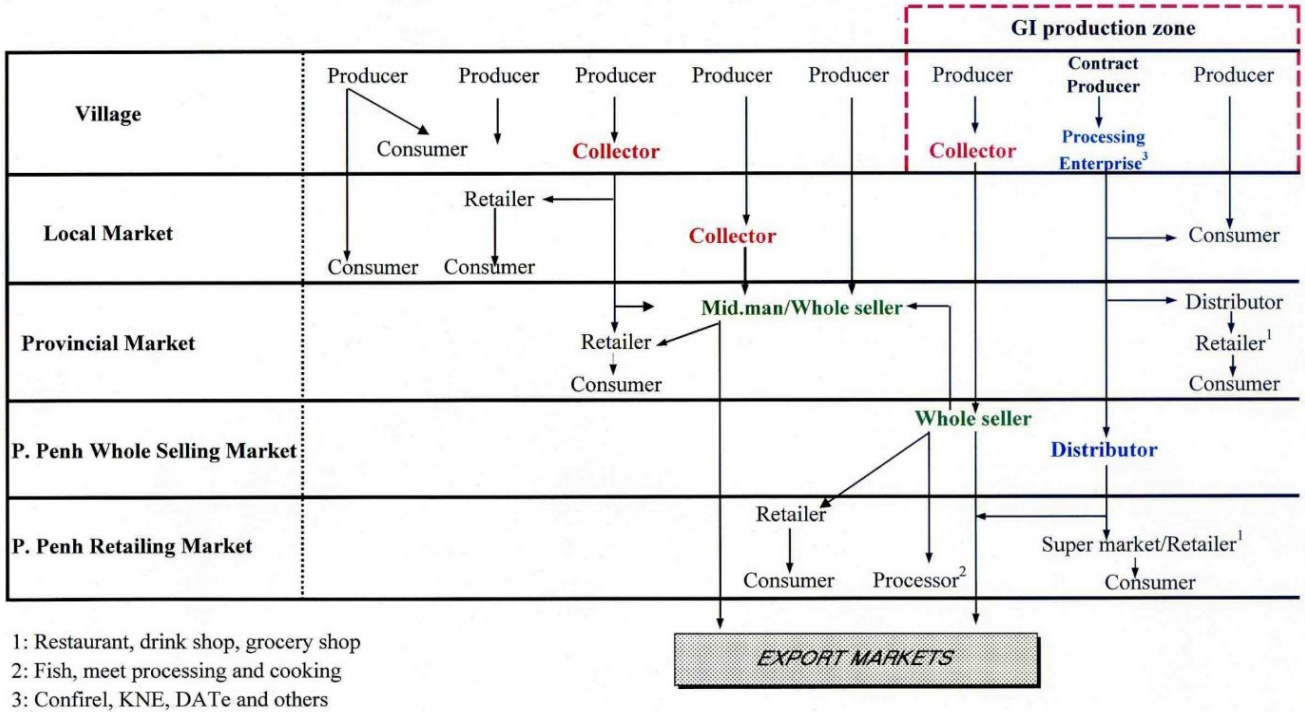
Table 4. Return on investment

Producer type	Sugar (kg)	Incomes (Riel)	Expenditures (Riel)	Net incomes (Riel)	Person-working day/ season	Return to labour (person-working day) (Riel)
Kampong Chhnang	2,141	4,758,000	1,695,717	3,062,283	351	8,719
Kampong Speu non-KSPA	1,730	4,182,500	1,840,303	2,342,197	373	6,282
Kampong Speu-KSPA	1,704	6,619,260	1,288,474	5,330,786	377	14,132

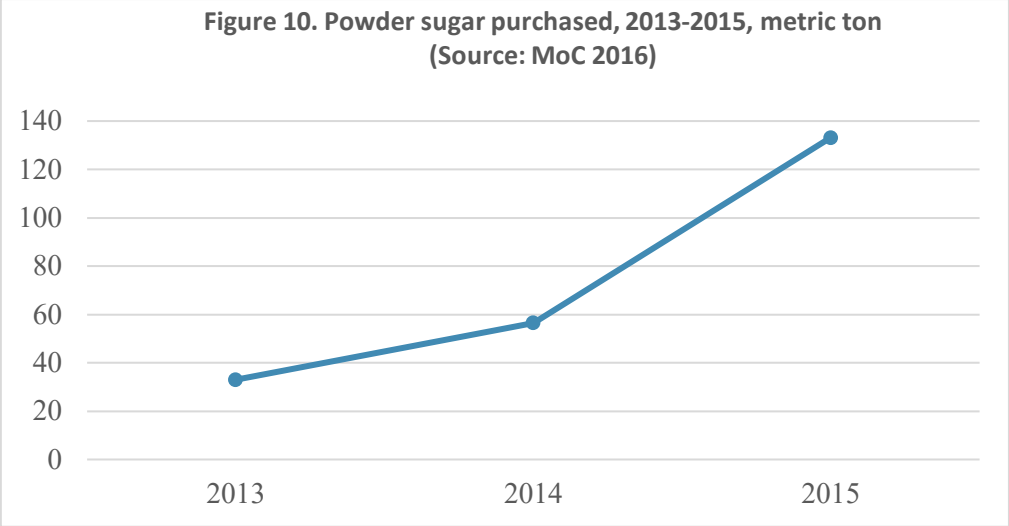
Source: MoC (2016). *Note: person-working day for climbing tree to collect sap plus person-working-day for processing (US$1=4050Riel)*

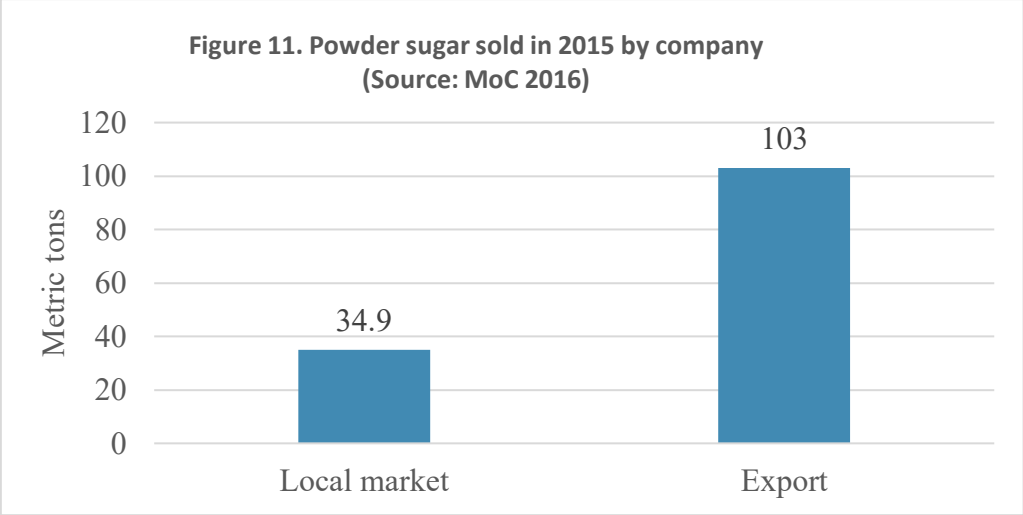
Profit (return to labour): According to Table 4, it is interesting to look at the profit (return to labour per person working day) of each group.

Figure 9. Palm sugar supply chain



Source: GI project (MoC & MAFF)





The Kampong Speu non-KSPA group receives the lowest return to labor at 6,282Riel. Despite producing the lowest volume at 1,704 kg, the Kampong Speu-KSPA group receives the highest return to labour on investment at 14,132Riel. One of the reasons is the higher price per unit product of GI powder and organic received from the market compared to the ordinary sugar product.

Production cost: Table 4 also describes the production cost of palm sugar in 2015. Production cost varies across the different groups of producers. Producers in Kampong Speu (non-KSPA) seem to have the highest production cost at 1,840,303Riel. Producers who are members of KSPA have the lowest production cost at 1,288,474Riel.

Productivity: Table 5 compares the productivity of Cambodia with two other countries in the region that have similar production systems, namely Indonesia and the Philippines. Of the three countries, Cambodia has the lowest sugar break ratio at 10-12 per cent, while Indonesia has the highest at 14 per cent. This results in the lowest sugar yield per litre of sap at 0.10kg of sugar, while Indonesia has a rate of 0.20kg of sugar. In the case of Cambodia, since the production occurs only six months a year, the content of sugar in sap varies across months. In December, the content is low and from January to February the content is medium, while from March to May the content is high because this period is the dry season. This reflects the most productive period for palm sugar production.

Table 5. Comparison of palm sugar productivity

Country	Sugar break ratio (%)	Length of season	Sap (yield/ tree/day) litre	Sugar yield/ litre	% sugar powder	Anti-fermenting agent	Tree service/ day
Cambodia	10-12	Dec-May	8.5	0.10kg	10	Popel wood	20-30
Indonesia	14	all year	3.0	0.20kg	30	Limestone, mangosteek bark	20-30
Philippines	12.5	all year	4.0	0.17kg	NA	none	up to 150

Note: Sugar break ratio is the percentage kg yield of sugar from sap. Higher yield in Cambodia due to length of season is short from Dec-May. Source: Ananda Ventures (2017)

Responsiveness

Information flow: Within Kampong Speu province, there are two groups of producers. One group is the membership of KSPA and the other group is outside KSPA. Farmers who are members of KSPA know that they could make more profit out of their product by improving their production fulfilling requirements of KSAP for export markets. For instance, organic sugar has a higher price than ordinary sugar. However, producers seem not to have this market information. The buying price of organic sugar is US$1.08/kg, while exporters can sell at US$2.80/kg. This indicates that exporters are making a good margin as the price of the sugar increases almost threefold.

Response time: Although farmers are producing different type of products (GI, organic, ordinary), the responsiveness of the palm sugar chain is relatively low as the production of this commodity is seasonal, which occurs from December to May. Farmers who produce the product are smallholder farmers with limited capital investment. Thus, they do not have facilities to store the products to make sure that they are able to supply year long. However, the collectors, wholesalers and exporters from the seven companies operating in the country have the capacity to buy large amounts of product from producers. In addition, in 2017, another two major international buyers entered the market. They are likely to buy all available products from farmers in order to respond to increasing demand. This creates great potential for farmers to find ways to produce more in order to meet the demand.

Customer satisfaction: Cambodian palm sugar has been exported to 25 countries, including the United States, France, Germany, Japan, Taiwan and Korea. Since the emergence of this commodity over the last 15 years, consumer satisfaction is reflected by the absence of any product recall or return to date. Consumers are satisfied with the taste and other the benefits of Cambodia palm sugar, one of which, as noted, is low glycemic index.

The recent registration in the European Union for Kampong Speu palm sugar as a protected Geographical Indication product will make this commodity better known and can be expected to increase consumer satisfaction.

Environmental aspect: Sugar production from palm trees is more environmentally sustainable and more adaptable to climate change as the trees require considerably less water and are more drought tolerant compared to sugar produced from other sources such as sugarcane. The trees require minimum inputs such as pesticides and fertilizers (in some cases none) which has a positive effect on soil nutrients. Furthermore, palm trees are more productive than sugarcane in terms of sugar yield.

Palm sugar production has the potential to grow according to current global market demand for sugar substitutes.

Challenges

Governance system

Despite being an emerging commercial commodity over the last 15 years, there is little documentation on this commodity. In 2016, a study on the palm sugar value chain was carried out by Agrifood Consulting International (ACI) for the Ministry of Commerce, which described the general situation of the sector. This study also documented what has been previously done by government, development projects and private companies.

Continuity of technical and financial support to this sector seems unclear in the long run as, so far, the support has been limited to a pilot project to support GI product status by the Ministry of Commerce and the Ministry of Agriculture, Forestry and Fisheries, with technical support from non-governmental organisations and funds from the French Development Agency (AFD).

Communication system

Since GI is a new concept, there are only a small number of producers who benefit from this scheme. One recent study shows that there are only 142 households in 15 villages who benefit from GI (MoC, 2016). This concept should be beneficial for other producers by scaling up to reach the maximum number of producers. In terms of commodity price, the selling price at the market increases three times compared to the price at the farm gate. In this case, producers seem to be not informed and they lack bargaining power to raise the price. In addition, the absence of contract farming causes losses to producers. The contract should be flexible in terms of price and can serve the mutual benefit of producers and exporters in the long run.

Production system

Another challenge for this sector is that most palm sugar producers are smallholder farmers who have limited investment capital and limited technical skills to maximise production and optimise quality. In terms of capital investment, they do not have sufficient for building facilities to store product in order to enable supply year-round. Most of them use traditional techniques in their production. For instance, they use conventional cookstoves which burn firewood to process sap. They should investigate other techniques such as improved or electric cookstoves. In terms of technical skills, the majority of producers still have limited knowledge on how to produce good quality products responding to market expectations.

In addition, product supply is unreliable. Generally, palm sugar production occurs during the dry season (December to May). This puts pressure on exporters during the off-season as they need to maintain regular supply.

Labour and the danger of climbing trees

Palm sugar production requires intensive labour, climbing trees up to 6.5 hours and another 6.3 hours for processing sap per production cycle/day (Ananda Vendure, 2017). As noted, only men are involved in climbing trees to collect sap, while women are engaged in cooking and processing sap at home. This implies that, for families who do not have sufficient labour, they may not be able to engage in this production. Tree climbers are becoming old, while the younger generations are

moving to cities to work in other sectors such as garment factories and other service sectors. In addition, tree climbing methods have changed slightly over time. The incidence of accidents which have led to serious or minor injuries is 22 per cent (MoC, 2016). Overall, palm sugar production could be dangerous for some climbers, while making marginal profit.

Suggestions for Improvement

Capital investment

Since the majority of producers are smallholder farmers, it is necessary to consider capital investment as an important factor to drive growth. Sufficient investment could lead to improved production facilities delivering the quality of the product required by exporters and lead to higher incomes for producers. Government agencies and relevant stakeholders should collectively collaborate finding funds to support producers. One of the strategies could be working with micro finance institutions to explore loan options that could promote palm sugar production. For instance, a low-interest rate loan for palm sugar producers.

Some exporters have reported that they were not able to supply overseas markets due to irregular supply from local producers. Having support for capital investment for producers could significantly address this issue and make the chain better functioning.

Improving production

In terms of production, training on quality control and production techniques is necessary in order to produce good quality products to meet the GI standard. Although, some producers have been trained to improve product quality, many more still need it. The majority of producers use conventional cookstoves which can be replaced by more efficient techniques.

It is necessary to learn about the production system from neighbouring countries in the region, such as Indonesia and the Philippines. While Cambodia is able to produce palm sugar for 6 months a year, techniques and methods that can enable production year-round could be adopted and modified. By having year-round production, it could improve the supply chain while maintaining regular incomes of producers and exporters. Eventually, this will lead to improvement of the whole chain.

Taking advantage of existing GI certification

Private sector stakeholders and government agencies should build on existing GI schemes. The concept of GI is relatively new for many palm sugar producers, despite having been promoted by the Ministry of Commerce since 2010. On the other hand, the registration of Kampong Speu palm sugar as a GI product of the European Union in April 2019 seems to attract many exporters to invest in this sector. The registration has made Cambodia palm sugar well known. It can provide opportunities for the sector to grow by expanding production and diversifying products. In addition, producers should prioritise producing palm sugar for the European Union market, as the products offer high value compared to ordinary products. The next stage of activities should be focused on raising awareness of palm sugar stakeholders, in particular the producers, who have limited knowledge about the benefit of GI for their products.

Contract farming

Contract farming arrangement should be encouraged in order to improve the function of the palm sugar supply chain. Some companies that export palm sugar have made direct contracts with

producers, while some have made contracts through palm sugar associations. However, more contracts should collectively be made between the palm sugar association and buyers. Contract farming can assist producers and exporters to estimate the amount to supply and to buy to meet overseas purchase orders and achieve a fair return. Moreover, it helps both parties to minimise risks that could occur along the chain. The contract should set out the minimum price that the parties agree to and the timeframe of activities and other necessary conditions.

Research and development

Since palm sugar is an emerging commercial commodity, it is important to document lessons learnt, opportunities and challenges for this commodity. Further research on market analysis is also necessary as the global market of sugar substitute is growing rapidly. The research and study should also measure the impact of GI schemes that are supported by the Ministry of Commerce in order to respond promptly to emerging market requirements.

Other recommendations

Apart from the above main suggestions, Table 6 summarizes some recommendations previously made by the Ministry of Commerce (2016), and key actors of different stages from production to processing, and trade and marketing.

Conclusion

Palm sugar has become a commercial commodity over the past 10 years, which has attracted many investors and exporters, although the Cambodian people have grown it since ancient times. GI schemes are supporting the growth of the palm sugar sector, export markets play an important role for the commodity (GI and organic products) and local markets are rapidly growing. However, the sector has great potential for further growth in the long run.

Despite showing progress, the production methods are traditional and face some issues along the chain. Most producers are smallholder farmers who have limited capital investment and cannot supply product year-round. In terms of production methods, producers have limited knowledge and skills on quality control that are required by the export market. In addition, part of the production requires high labour intensity tree climbing to collect sap which could face serious danger.

There are some suggestions for improving the chain. Since many producers have insufficient capital investment, availability of low-interest rate credit could be one solution for the upstream actors (producers) of the chain. The capital can be used for improving facilities and production materials. Although the production system is traditional, this could be improved through offering necessary skills and technical training to producers to produce good quality products. Relevant stakeholders in the chain can take advantage of existing GI schemes by expanding production and diversifying products for export markets. In addition, the palm sugar value chain can effectively function through making contracts between palm sugar associations and buyers as it could help minimise risks along the chain.

However, to implement the above suggested improvements, it requires close collaboration among relevant stakeholders, including public and private sector, producers and development partners. This can help to ensure information flow amongst actors in the chain. In addition, a policy to promote the growth of the sector is needed and should be supported by a long-term strategic plan. Overall, the suggested improvements may be achieved with long term financial support but requires effort and commitment from all stakeholders.

Table 6. Recommendation matrix

Stage of value chain	Recommendation	Key actors	Time frame
Input to production	Establishment of nurseries	GDA	Short term
	Development or importation of high yielding varieties with shorter maturity	GDA	Short term
	Study on soil and water use management	GDA, CARDI	Short term
Production	Demonstration farms	GDA	Short term
	Improve system for sap collection	GDA	Short term
	Improve methods of sap collection with possible use of mechanization	GDA	Medium term
	Promotion of crop cultivation	GDA innovation fund to private companies/farmers	Medium term
Processing	Identification of organic substitute of Popel wood	GDA, CARDI	Short term
	Improve stove using gas or electricity	GDA and Investment fund to promote private sector innovations	Short term
	Mechanized system for stirring and sieving	GDA and Investment fund to promote private sector innovations	Short term
	Product development	GDA and Investment fund to promote private sector innovations	Short term
Trade and marketing	Improved packaging	MoIH and investment fund to promote private sector innovations	Short term
	Brand recognition (differentiation from coconut palm sugar	MoC	Medium term
	Business to consumer platforms for organic product	MoC	Short term
	Participation in trade fair for organic products	MoC	Short term
	Research on health and nutrition effects of palm sugar	MoH	Short term
	Organic certification	MAFF and MoC	Short term

Source: MoC (2016). Note GDA - General Directorate of Agriculture; CARDI - Cambodian Agricultural Research and Development Institute; MoIH - Ministry of Industry and Handicraft; MoC - Ministry of Commerce; MoH - Ministry of Health.

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