

A VALUE CHAIN OF PALM SUGAR PRODUCTS: THE CASE OF KHMER PEOPLE IN CHAU LANG VILLAGE, TRI TON DISTRICT, AN GIANG PROVINCE, VIETNAM

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ABSTRACT

Climate change can cause problems for livelihood protection in dry areas. Thus, studying the agricultural value chain can provide baseline information to support livelihood protection for climate change effects. Accordingly, this study was carried out in both quantitative and qualitative methods in Chau Lang of the Tri Ton district, where it is known that 65% of the village's families are Khmer. With the aid of in-person interviews using a pre-tested questionnaire, a semi-structured interview schedule, and an open discussion method, primary data were gathered from 250 sampling observations from various stakeholders, including 105 farmers and 145 intermediaries in multiple channels. The findings showed that the average cost of production for one kilogram of palm sugar was 5,302 VND. The marketing chain consists of three main channels: Channel 1: Farmers - Middlemen - Wholesalers - Retailers - Consumers; Channel 2: Farmers - Wholesalers - Retailers - Consumers; and Channel 3: Farmers - Retailers - Consumers. Where Channel 3 has the greatest marketing efficiency, at 19.52%, followed by Channels 2 and 1, at 18.36% and 15.76%, respectively. Additionally, Channels 1 and 2 have lower monopoly index values than Channel 3, suggesting trader dominance in marketing palm sugar products. It also demonstrates how little influence artisans have on the product price. An enterprise that aids artisans in selling palm sugar must grow in Chau Lang Village. To encourage the Khmer to continue working in the village as they have done for generations, it is important to find how to help these households and boost the income from palm sugar production.

1. INTRODUCTION

Sweeteners are well-known nowadays, many people are at risk of developing diabetes, obesity, hypertension, and heart disease as a result of excessive sugar consumption in meals, drinks, and sweets. (Chattopadhyay, Raychaudhuri, & Chakraborty, 2014; Asghar et

al., 2021& 2020). In 2018, the World Health Organization (WHO) projected that 451 million people globally had diabetes, and 43% of all deaths before age 70 were attributed to diabetes. Low-sugar, sugar-free, and synthetic sweetener products have become widespread (WHO, 2018). However, many of them may be

dangerous, potentially contributing to health issues such as weight gain, brain tumors, and even cancer (Kroger, Meister, & Kava, 2006; Sharma, Amarnath, Thulasimani, & Ramaswamy, 2016). Dieticians and the food industry consider natural and artificial sweeteners vital to the contemporary diet. Therefore, sugar products should be reformulated—to the healthier. Low glycemic index natural sweeteners may help combat diabetes (Asghar et al., 2020). Palm sugar is a natural sweetener with a unique taste and appearance that cannot be replicated. It also naturally colors food and drinks brown (Asghar et al., 2021). Palm sugar has been used as a sweetener in Asia for millennia. It has gained global popularity because it's natural, less processed, and has a low glycemic index (GI), one of its notable health advantages (Srikaeo & Thongta, 2015). Palm sugar is palm derived. The *Arecaceae palmmyra* (*Borassus flabellifer* Linn.) grows wild from the Persian Gulf to the Cambodian-Vietnamese border, it is cultivated in India, Malaysia, Southeast Asia, Hawaii, and southern Florida. Palms contribute to environmental sustainability by improving soil health and requiring minimal water. The flower's sweet nectar, along with various edible products from the leaves, trunk, and underground seedlings are consumed, as is the thin orange flesh of the mature fruit. Consequently, these products hold significant socioeconomic relevance for the rural poor (Srikaeo, Sangkhiaw, & Likittrakulwong, 2018). The global impact of sugar companies is substantial suggesting that exports can continue to increase. Sugar-based products, especially palm sugar, enjoy international popularity with Europe, America, and Japan being key export destinations (Fitriwati, 2021). The main purpose of the paper is to maintain competitiveness and ensure business sustainability, increase the income of farmers and craftsmen, and support

economic development. Research is needed to determine the viability of current business and marketing strategies, as well as explore alternative marketing approaches for Chau Lang's palm sugar agro-industry.

2. METHODOLOGY

2.1 Location of study area

From September 2019 to April 2020, a study was conducted in Chau Lang Village, Tri Ton District, An Giang Province, in the Vietnamese Mekong Delta region. The village was chosen using purposive sampling for several reasons. First, the number of Khmer people is 2,339, accounting for 65% of the total population. Second, the palm tree is a cultural symbol of the Khmer people in this area. Third, the palm tree yields a variety of unique products, such as Palm sugar, palm sweet soup, palm chopsticks, palm juice, palm wine, and artwork made from palm leaves. These products help to improve the livelihoods of a portion of the Khmer community. Therefore, the palm tree not only brings ethnic and cultural values to the Khmer but also provides economic value, especially to the Khmer poor households with little or no land, who rely on palm sugar production for their livelihoods.

2.2 Data collection technique

Data collection was carried out using key informants' interviews (KII), focus group discussions (FGDs), and a questionnaire survey with face-to-face interviews. Additionally, direct observation of the production, packaging, and marketing activities of palm sugar was conducted with palm sugar producers (farmers) and other stakeholders in the study area.

Particularly, FGDs were adopted using several tools from participatory rural appraisal (PRA) (Neela, 1993) to collect data at the community and household levels. These tools included a timeline, seasonal calendar, Venn diagram,

Ranking, and the strengths, weaknesses, opportunities, and threats (SWOT) matrix.

Primary data collection relied on a standardized questionnaire. Structured interviews were conducted to gather data using these questionnaires. A total of 105 households were surveyed. Palm sugar-producing families in the commune were randomly chosen. The structured questionnaires were pretested (10%) before

interviews. The questionnaires covered the following topics: (1) demographic information of households, (2) income-generating activities and sources of income, (3) the pros and cons of sugar palm cultivation and processing, (4) livelihood assets, options, and strategies, and (5) perception of the social, economic, and cultural values of sugar palm trees and the palm sugar value chain in the region.

Table 1. The number of sampling observations

Stakeholders	Observations	Data collection
Province leader	1	
District leader	1	
Commune leader	1	
Hamlet leaders	4	Key informants' interview
Department of Labour and Social Welfare	3	
Department of Agriculture & Rural Development	3	
Experts at the university, and Research Centre	3	
Farmer and woman Unions (district and commune)	4	
Farmers (craftsman)	105	Questionnaire
Middlemen/collectors	3	
Local wholesalers	2	Key informants' interview
Local retailers	8	
Consumers (local consumers, tourists, and others)	12	
Others		
Finding the relation among farmers and organizations (the bank, local government, the Department of Agriculture and Rural Development, the Department of Industry and Trade, union of farmers, union of women, middlemen, etc.) in the region.	20	(10 people/group x 2 groups)
Total	170	

2.3 Data analysis

In this study, the supply chain mapping technique was used to identify links interactions and transactions between participants. This method, illustrates the information and activity flow between direct and indirect participants at each supply chain channel, helping to highlight

stakeholder characteristics stakeholder characteristics.

To calculate the value percentage of each actor in the value chain and to define the features of the primary actor of the Chu-mango distribution system, descriptive statistics were used. Frequency, percentage, mean, and standard

deviation are used to show the descriptive statistics in tables (Dominic, Rodd, & Tiago,

2020; Douglas, Jason, André, & Maximo, 2016; Trienekens, 2011; Kaplinsky, & Morris, 2003).

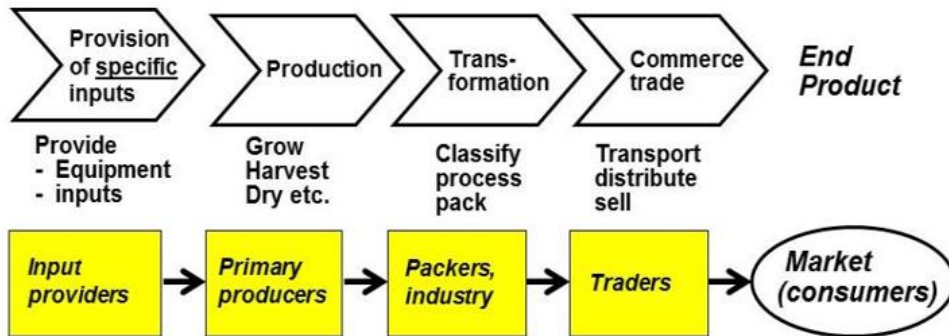


Figure 1. Supply chain map

(Source: Andreas 2018)

The marketing efficiency (ME) and the monopoly index (MPI) are calculated in this study. The marketing margin is computed using the price disparity between marketing agencies, which is quantitatively expressed in equation (1).

$$MM = Pr - Pf \quad (1)$$

Where,

MM = Marketing Margin (VND/kg).

Pr = Price on trader level (VND/kg).

Pf = Price on craftsmen trader level (VND/kg).

Any channel's marketing efficiency (ME) is measured by the farmers' share of customers' money and price distributed along the supply chain (Dastagiri et al., 2013). The farmer's net price after marketing cost and margin determines ME. Formula: Acharya's ME formula (Dastagiri, & Chand, 2010; Dastagiri et al., 2013; Panda, & Sreekumar, 2012).

$$ME = TM/TPV \times 100 \quad (2)$$

Where,

ME = Marketing efficiency (%)

TM = Total marketing costs (VND)

TPV = Total product value (VND)

Decision rule:

0 - 33% = efficient

34 - 67% = less efficient

68 - 100% = inefficient

The monopoly index uses an equation (3) to determine the trader's monopolistic power on the marketing channel.

$$MPI = MM/VC \quad (3)$$

Where,

MPI = monopoly index.

MM = marketing margin

VC = variable cost

3. RESULTS AND DISCUSSION

3.1 The relationship between farmers (producers) and organizations

According to the palm sugar production Venn diagram, farmers have strong connections and regularly interact with their families, neighbors, and friends. They often discuss palm sugar production and other aspects of life with them. Farmers might seek assistance from family or neighbors when needed. In emergencies, such as falling while climbing palm tree to collect sap or

getting burned during the boiling. Their neighbors or family members may rush them to the hospital.

Farmers like local employees but not social groups (farmers’ associations, women’s associations, formal financial institutions, or NGO programs) or domestic clients (local people, street stalls, and village markets). Local personnel may aid farmers with documentation to access informal credit services for preferential credit schemes. Regional staff also collaborates with DARD or NGO initiatives to offer training courses on knowledge and skills, technology, food safety, trademarks, and branding, aimed at improving technical information on palm sugar, helping farmers increase their production capacity and revenue.

Some farmers use local informal credit services to borrow money quickly without the need for collateral. They can borrow from village

intermediaries or loan sharks at extremely high interest rates to buy essentials for production or family needs. Loan sharks typically charge 10% per month. If the loan shark is a palm sugar buyer (middleman), the farmer may be forced to sell directly to him at a price lower than the market rate. Farmers resort to informal credit services only in emergencies.

Companies purchase in bulk, so farmers rarely sell directly to them. According to PRA and KII data, private companies prefer to buy palm sugar products from the Khmer poor to help them increase their income and stability by signing supply contracts. However, most Khmer people are not interested in working with firms due to a lack of education and concerns about meeting delivery deadlines. Normally, palm sugar is manufactured by using traditional methods, with small-scale and scattered operations.

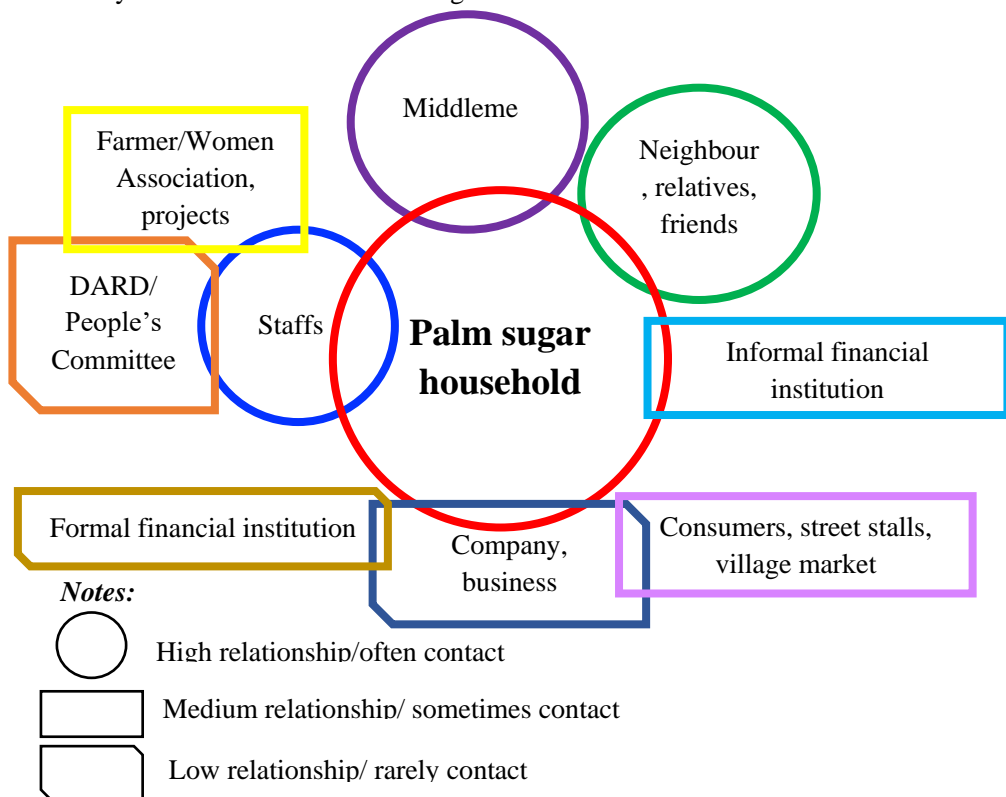


Figure 2. The Venn diagram of palm sugar production

3.2 Seasonal calendar

According to the household survey and FGDs, each household has an average of 30 palm sugar trees with a minimum of five and a maximum of 110 trees. Palm sugar production begins in the dry season, starting in November and continuing until June or July the following year. Growers prepare production instruments and supplies in early November, including bamboo sticks for

ladders, plastic containers for collecting sap and storing sugar, wood or fuel, large pots, stoves, and *Shorea cochinchinensis timber*, which is used to palm to lower the pH of palm juice and enhance the flavor and color of palm sugar. Once preparation is complete, palm sugar production begins. Growers tend to produce more and higher-quality palm sugar in January due to sap flow from palm trees and the hot temperature, which improves sap quality.

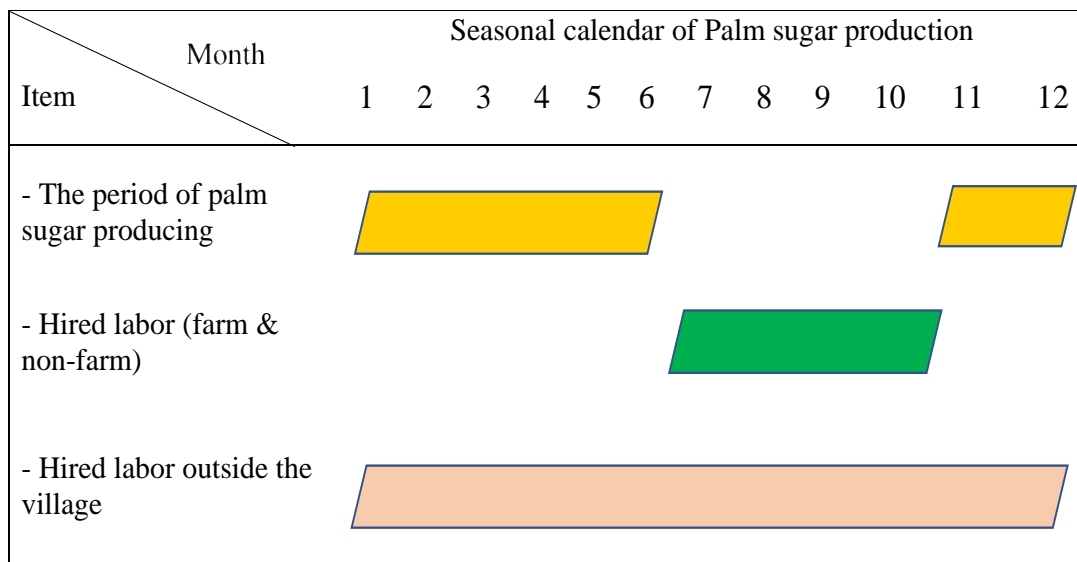


Figure 3. The seasonal calendar of palm sugar production

The rainy season in the Mekong Delta runs from June to October. Since rainfall affects the quality and sugar content of palm sap, growers halt production during this season. Farmers also face the risk of falling trees due to the slick surfaces of the palm trees. As a result, they seek alternative income-generating activities until the palm sugar season resumes in November for the mountainous terrain, many turn to growing rice or cash crops during the rainy season (June–November). Landless farmers may also find work outside the commune as bricklayers, agricultural laborers, or lottery ticket sellers. Focus group discussions—revealed that most young people leave the village to work full-time in industrial zones in Binh Duong or Binh Hoa,

returning home only for major occasions such as the New Year holiday.

A major challenge for the palm sugar industry is that most producers are smallholder farmers with minimal access to capital and technical expertise to raise production and improve quality. They cannot afford storage facilities to ensure year-round supply, and most rely on traditional production methods. Palm sap is typically processed using firewood-burning stoves through improved or electric stoves should be considered for better efficiency. Additionally, most firms lack the technology to consistently deliver high-quality products that meet customer expectations, leading to fluctuating product

availability. Palm sugar is produced during the dry season (December to May), and exporters must find ways to maintain supply during the off-season.

3.3 The process of palm sugar production

Sugar palm farmers in Chi Lang village benefit significantly from palm trees, which grow abundantly in the area. The farmers harvest the

sap from sugar palms to produce palm sugar juice for beverages. Some farmers process the sap outdoors, while others bring it indoors to make sugar. The interview revealed that palm sugar production follows a methodical process. Interestingly, bees are often found near male flowers ready for tapping as these flowers provide nectar for honey production.



Figure 4. The process of palm sugar production

Most operations, from cultivation to processing, involve various participants. Women are responsible for processing the sap, while men climb the trees to obtain it. Exporters, regional producer organizations, and wholesalers are also involved in aggregating, packing, and selling palm sugar. The manufacturing process is multi-step: sap collectors first prepare containers, ensuring they are thoroughly cleaned to remove dust. Then, they add the *Shorea cochinchinensis* timber as an additive into the containers to enhance the quality of the sap. In the afternoon, men farmers attach pots to the palm flower allowing the sap to flow into the containers overnight. Farmers typically use 15-meter-long bamboo sticks to reach the tall palm tree often requiring 2 or 3 bamboo poles to access the top. This work can be dangerous: careless farmers may fall resulting in injuries. Consequently, only male farmers typically perform this task.

The next morning, male farmers harvest the palm sap, which is filtered to remove

contaminants. The sap is cooked for 4–6 hours until it condenses. According to the information from focus group discussions, palm sugar growers use 6 -10 liters of palm sap to produce 1kg of palm sugar, with the quality depending on the weather conditions. This cooking process may take 2 hours. Finally, palm sugar is sold in 1kg canisters. Male laborers are responsible for harvesting the sap, while female laborers handle the cooking, creating a balance in household gender roles.

3.4 Cost structure of palm sugar production

The household survey revealed that farmers typically produce palm sugar for seven months each year, working almost daily during this daily. On average, each family produces 18 kg of palm sugar daily, resulting in approximately 533 kg of palm sugar per household every month.

While some farmers sell their gathered palm sugar at the local market, others who do not rent

out their palm trees to wholesalers or brokers sell directly to consumers at the farm gate. The primary issue in the supply chain is the farmers' inability to reach the markets. Additional challenges include inadequate packaging, low prices for producers, and monopolistic practices among stakeholders. The majority of issues in the supply chain are farmers' limited access to the market. Most farmers believe that the influence of brokers and wholesalers is the most significant factor affecting the supply chain. Figure 5 displays the information regarding manufacturers' production costs. Total production costs for the farmer are 5,302 VND/kg, with gasoline being the largest expense at 1,817 VND/kg. The second major cost is the rent for palm trees (828 VND/kg), followed by bamboo cost at 549 VND/kg. Other expenses are relatively similar, averaging around 400 VND/kg.

In general, fuel and bamboo are the two biggest costs in the production of palm sugar, particularly for families that do not need to hire palm trees. The collection of sap and the heating of palm sugar are crucial processes that rely on these resources. For the growers of palm sugar, the costs of production are still considerable, even if they are not excessively high. Since most producers belong to impoverished Khmer communities, they struggle to invest in essential items like pots, bamboo, cookers, fuse wire, and plastic bottles, before beginning production. Although this amount may seem minimal for investing in palm sugar production, it indicates that they may lack the funds to acquire the necessary equipment. Despite having incomes above the poverty threshold, their earnings are still modest.

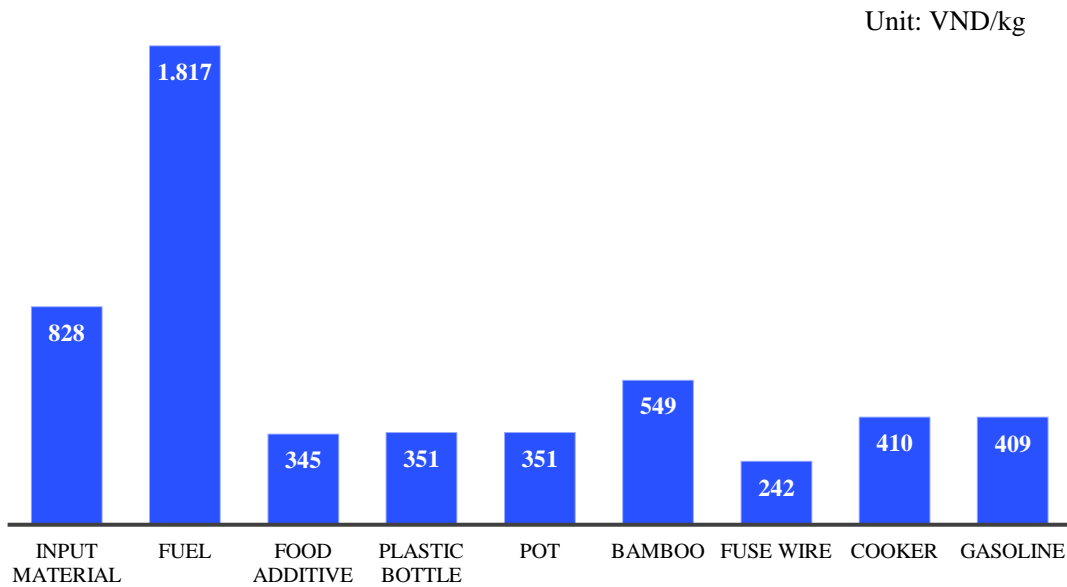


Figure 5. Production cost structure for 1kg of palm sugar

3.5 Marketing channels analysis of palm sugar

Producers, merchants, enterprises, cooperatives, exporters, and others directly participate in the palm sugar value chain. The product reaches customers through many ways, including producers, merchants, and domestic markets. Exporters are compensated by cooperatives or merchants. Household surveys, FGDs, and in-depth interviews have identified the key players in the palm sugar value chain, which include suppliers, palm sugar producers, collectors, distributors, retailers, and domestic customers. Four distinct palm sugar value chains have been established in Chau Lang village, Tri Ton district (Figure 6).

The value chain map shows that collectors purchase 90% of palm sugar produced. Of this, wholesalers acquire 80% while retailers obtain 10%. Farmers directly sell 5%, 3%, and 2% of their palm sugar products to wholesalers, merchants, and domestic consumers, respectively. Then, wholesalers offer all palm sugar goods 85% sourced from farmers and collectors to merchants. Finally, merchants sell 98% of the palm sugar goods gathered from farmers, collectors, and wholesalers to domestic customers in rural-urban markets, tourist spots, stores, supermarkets, etc. Three main marketing channels exist in Chau Lang village, Tri Ton district, An Giang province.

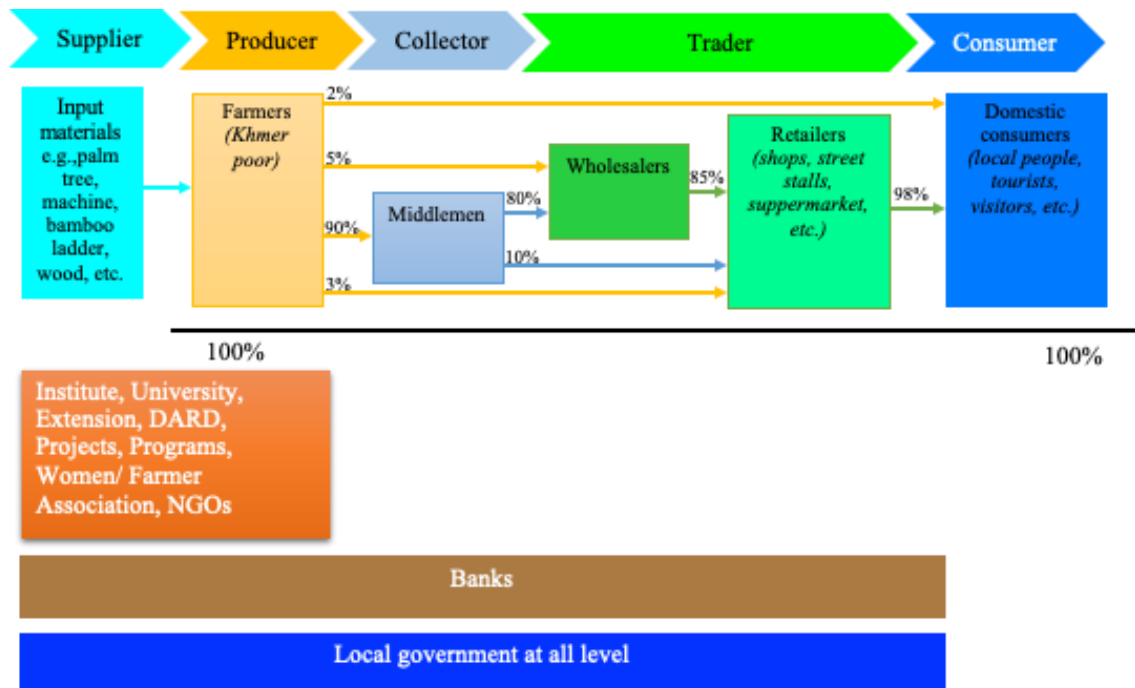


Figure 6. Palm sugar value chain

❖ Channel 1: Farmers → Middlemen → Wholesalers/Retailers → Consumers

This is the principal marketing route for palm sugar goods in Chau Lang commune, Tri Ton district of An Giang province, as well as for others from the Mekong Delta in Vietnam.

Producers, collectors, distributors, and retailers are the primary players. The process involves the production, collection, wholesaled/resold and consumption of palm sugar. This channel distributes 90% of liquid palm sugar products to wholesalers (agents or private firms) and

retailers (local markets or street stalls). After acquiring a large quantity of products from collectors, private firms utilize innovative processing and packaging techniques to create a variety of products that cater to market demand. However, private companies will provide diverse items to meet client demands, including liquid, concentrate, and tablet form of palm sugar which simplifies home cooking. They sell palm sugar packaged in leaves as a soluble powder, and in tablet form to shops, supermarkets, stores, hotels, etc. Thus, this marketing route not only maintains product quality but also facilitates large-scale supply.

❖ Channel 2: Farmers → Wholesalers →
Retailers → Consumers

Producers (farmers), wholesalers (agents), and retailers comprise this route (street stalls, village markets), which supplies 5% of palm sugar. Farmers sell directly to palm sugar agents without contracts, allowing them to sell their produce at any time. The brokers indicate that most rural farmers rely on them for loans in preparation for the upcoming season. After harvesting and processing, farmers are expected to sell directly to the agency, which sets the prices based on market conditions. The agency acquires the products from farmers, reprocesses them using machines, and then packages them for sale to retailers. The packaging by agents and merchants is relatively simple, typically using nylon bags to sell palm sugar in concentrate or tablet form, weighing either 0.5kg or 1kg. However, this channel struggles to provide large quantities or ensure consistent product quality.

❖ Channel 3: Farmers → Retailers →
Consumers

Farmers sell palm sugar directly to businesses and stalls along the main road, small markets, and tourist spots in An Giang province, such as Bay Nui. The retailers in this primary consist of

merchants from the Tri Ton and Tinh Bien districts, as well as from the eco-tourism-developing Long Xuyen and Chau Doc cities. This channel's growers prefer to transport palm sugar directly to merchants, which allows them to benefit from increased market prices due to value-added offerings. Farmers report that demand constantly exceeds supply, and retailers are increasingly seeking higher-quality products than those offered by wholesalers. As a result, only 3% of palm sugar growers utilize this route. This channel sells palm sugar as a keepsake or gift. However, because farmers cannot guarantee a steady supply, sales are made without formal contracts. Given the growth of ecotourism in An Giang, this channel presents significant expansion opportunities.

Marketing channel distribution requires efficiency. If this works, all marketing channel institutions will profit. Thus, excellent marketing channels benefit farmers/producers, merchants, and consumers. Table 2 shows the efficiency of the marketing channel in the study region.

The data indicate that three marketing channels are efficient, as their efficiency value is all below 33%. Among these, sales from farmers to retailers (channel 3) exhibit the highest efficiency at 19.52. In contrast, when commission agents and merchants are involved in the sale of palm sugar, marketing efficiency declines to 18.36 and 15.76 for channels 2 and 1, respectively. This trend illustrates that as the number of marketing intermediaries increases, the overall efficiency decreases. This finding aligns with the research of Ajani (2005) and Ladaniya et al (2005).

Channel 3 has a monopoly index (MPI) of 0.68, which is significantly higher than Channel 2's MPI of 0.42. This suggests that Channel 3 has greater control over pricing decisions and plays a dominant role in the marketing process with

collectors. In contrast, Channels 1 and 2 show lower MPI values than channel 3, indicating a greater dominance of traders in the marketing of palm sugar products. This situation highlights that producers have limited influence over

product pricing. To improve the position of craftspeople, business organizations like those in Chau Lang Village need to focus on developing strategies that support their selling palm sugar more effectively.

Table 2. Marketing Efficiency and monopoly index of Palm Sugar Marketing channels

Information	Channel 1	Channel 2	Channel 3
Total marketing cost (VND/kg)	21,974	20,774	14,974
Total variable cost (VND/kg)	109,102	84,902	52,802
Total product value (VND/kg)	139,424	113,124	76,724
Marketing efficiency (ME) (%)	15.76	18.36	19.52
Monopoly index (MPI)	0.33	0.42	0.68

4. CONCLUSION AND RECCOMENDATION

In Chau Lang Village of An Giang province, the palmyra tree often referred to as “the tree,” serves as one of the main income sources for the Khmer community, especially the poor. The traditional craft of producing palm sugar, deeply rooted in the heritage of the Khmer ethnic group, has been passed down through three generations. Beyond its cultural and ethnic significance, the palmyra tree provides economic value, particularly for the landless or small-land farmers who rely on harvesting and processing palm sugar for their livelihood. This practice not only preserves Khmer traditions but also supports the subsistence of many impoverished households.

The research findings show that in Chau Lang, the palmyra tree plays a significant cultural role in the livelihoods of Khmer families, as palm goods (palm sugar, palm juices, and palm fruits) provide a primary source of income in the region. However, the income generated from palm sugar production remains modest compared to other industries. This economic reality has led many young Khmer people to move to larger cities in search of employment

opportunities, as they are less inclined to engage in the palm sugar processing industry. To preserve this traditional craft and support the community, it is essential to implement measures that improve the income from palm sugar production. Increasing profitability could encourage younger generations of the Khmer community to stay in their village and continue the legacy of palm sugar production, which has sustained their families for generations.

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REFERENCES

Ajani, O. I. (2005). Economic analysis of the marketing of fruit in Lagos State of Nigeria (A case study of Oyingbo, Oshodi, and

- Ikotun markets). *Nigerian Journal of Horticultural Science*, 10, 38-46.
- Andreas, S-H. (2018). *Valuelinks 2.0 Manual: Manual on sustainable value chain development, value chain analysis, strategy, and implementation*. Eschborn: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), Germany.
- Asghar, M. T., Yusof, Y. A., Mokhtar, M. N., et al. (2020). Coconut (Cocos nucifera L.) sap as a potential source of sugar: Antioxidant and nutritional properties. *Food Science & Nutrition*, 8(4), 1777–1787.
- Asghar, M. T., Yusof, Y. A., Mokhtar, M. N., Yaacob, M. E., Ghazali, H. M, Chang, L. S., et al. (2021). A Review of Nutritional Facts, Production, Availability and Future Aspects of Coconut Palm Sugar. *Journal of Nutrition & Food Sciences*, 11(3), 793-800.
- Chattopadhyay, S., Raychaudhuri, U., & Chakraborty, R. (2014). Artificial sweeteners—a review. *Journal of Food Science and Technology*, 51(4):611-21.
- Dastagiri, M. B., & Chand, R. (2010). The Research Study on Estimation of Marketing Efficiency of Horticultural Commodities under Different Supply Chains in India. National Centre for Agricultural Economics and Policy Research, New Delhi.
- Dastagiri, M. B., Chand R., & Immanuelraj, T. K. (2013). Indian vegetables: production trends, marketing efficiency, and export competitiveness. *American Journal of Agriculture and Forestry*, 1(1), 1-11.
- Dominic, S., Rodd, D., & Tiago, W. (2020). *Making value chains work better for the poor: A toolbook for practitioners of value chain analysis (4th Ed.)*. Canberra: Australian Center for International Agricultural Research.
- Douglas, H., Jason, D., André, D., & Maximo, T. (2016). *Innovation for inclusive value-chain development: Highlights*. In D. André, T. Maximo, D. Jason, & H. Douglas (Eds.), *Innovation for inclusive value-chain development: Successes and Challenges* (pp. 3-34). Washington, DC: International Food Policy Research Institute.
- Fitriwati, Syahidah, Makkarennu, Syahid, & Syahwiah. (2021). *Potential analysis of palm sugar industry development in Lombo Village, Sidrap District*. IOP Conference Series: Earth and Environmental Science, Volume 886, 2nd Biennial Conference of Tropical Biodiversity 4-5 August 2021, Makassar, Indonesia.
- Kaplinsky, R., & Morris, M. (2003). *Handbook for value chain research*. Ottawa. International Development Research Center (IDRC).
- Kroger, M., Meister, K., & Kava, R. (2006). Low-calorie sweeteners and other sugar substitutes: A review of the safety issues. *Comprehensive Reviews in Food Science and Food Safety*, 5(2), 35–47. <https://doi.org/10.1111/j.1541-4337.2006.tb00081.x>
- Ladaniya, M. S., Wanjari, V., & Mahalle, B. C. (2005). Marketing of grapes and raisins and post-harvest losses of fresh grapes in Maharashtra. *Indian Journal of Agricultural Research*, 39(3): 167-176.
- Neela, M. (1993). *Participatory Rural Appraisal: Methodology and Applications*. Concept Publishing Company.
- Olukosi, J. O., & Isitor, S. V. (1990). *Introduction to agricultural market and price; Principles and applications*. Zaria: Agitab Publishers.
- Panda, R. K., & Sreekumar (2012). Marketing Channel Choice and Marketing Efficiency Assessment in Agribusiness. *Journal of*

- International Food & Agribusiness Marketing*, 24 (3), 213-230.
- Sharma, A., Amarnath, S., Thulasimani, M., & Ramaswamy, S. (2016). Artificial sweeteners as a sugar substitute: Are they really safe? *Indian Journal of Pharmacology*, 48(3), 237-240.
- Simbolon, S. B., Supriana, T., & Lindawati (2021). *Marketing strategy of brown sugar from palm oil in Serdang Bedagai District*. International Conference on Agriculture, Environment and Food Security:2020. IOP Conf. Series: Earth and Environmental Science 782 (2021) 022012 IOP Publishing.
- Srikaeo, K., Sangkhiaw, J., & Likittrakulwong, W. (2018). Productions and Functional Properties of Palm Sugars. *Walailak Journal of Science and Technology (WJST)*, 16(11), 897–907.
- Srikaeo, K., Thongta, R. (2015). Effects of sugarcane, palm sugar, coconut sugar and sorbitol on starch digestibility and physicochemical properties of wheat based foods. *International Food Research Journal*, 22 (3), 923-929.
- Trienekens, J. (2011). Agricultural value chains in developing countries: A framework for analysis. *International Food and Agribusiness Management Review*, 14(2): 51-82.
- WHO (2018). Global report on diabetes 2018. World Health Organization.