

# **Demand Modelling and Establishment of Supply Chain Management for Coconut Sugar in the Philippines**

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## **Abstract**

The Philippines is the world leading exporter when it comes to Coconut Sugar. The export market for this product currently on its high. This study aimed to determine the long-term demand for Coco Sugar, establish factors that affect the supply chain of Coco Sugar and recommend a supply chain management model for Coco Sugar in the Philippines that would accommodate all the current and potential demand of this product. The Camarines Sur is the highest coconut sugar producing province in Luzon that is why this province became the research locale of this study. To achieve all the objectives, survey and interview were conducted among the key players of the supply chain. Related literatures were reviewed to establish basis for the demand modelling and its projection. Forecasting methods were also used to project the long-term demand of the product. The analysis on the statistical tools resulted to the significant factors that affect the supply chain of coconut sugar. These factors were prioritized in the establishment of supply chain management plan. Also, root cause analysis was done to furthermore dig into the problems in the supply chain. Each stages of the supply chain come up with resolutions corresponding to each complications of the key players. Solutions to these problems were established, thus, generating a better value chain map of Coconut Sugar. An elimination of one chain player, the consolidator was one of the changes made in the Value Chain Map. The eliminated consolidators were converted into processors. This better version of value chain map offers cheaper price of Coconut Sugar at a larger range of market which not only caters local demand, but also the international ones.

## **Keywords**

Coconut sugar, supply chain management, value chain map, potential demand

## **1. Introduction**

The Philippines remains as the world's leading supplier of traditional coconut products. The coconut industry is a dominant sector of the Philippine agriculture. Over a quarter of the farmland in the Philippines is devoted to coconut planting and 68 out of 79 provinces are coconut areas. The industry is finding more products from the "tree of life" and one of these is the coconut sugar. The coconut sugar is a natural sugar that came from the coconut sap and is made from pure sweet watery sap that drips from cut flower buds of organically grown, fresh coconut tree. Sugar from sugar cane is the most popular and commercially produced and distributed sugar in the Philippines. An emerging, but yet relatively unknown sugar now in the market is one from coconut, known as coco sugar. It is derived from coco sap which is also the main source of traditional products such as tuba (coconut toddy), lambanog (liquor distilled from toddy) and vinegar (Ledesma et al, 1993). The product map of sap is shown in figure 1 below.

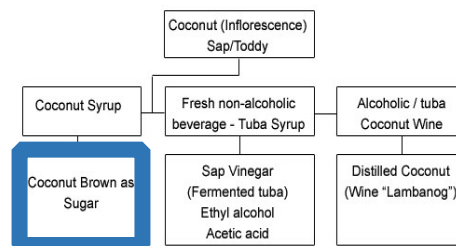


Figure 1. Derived Products from Coconut Sap

This study was focused in Camarines Sur in Bicol Region which contributes to 5% of coconut sap sugar production in the Philippines. Camarines Sur is the sole supplier of coco sugar in Bicol with one producer-exporter that has state of the art and world class facilities, the Coconut Republic. In 2012, Bicol produced 11 metric tons of coco sugar since it is the main local market nearest to Metro Manila.

## 2. Methodology

The study followed a framework as shown below in order to pursue and come up with the results. The framework provided the research a structure and guideline to have a clear idea and how the output design was constructed.

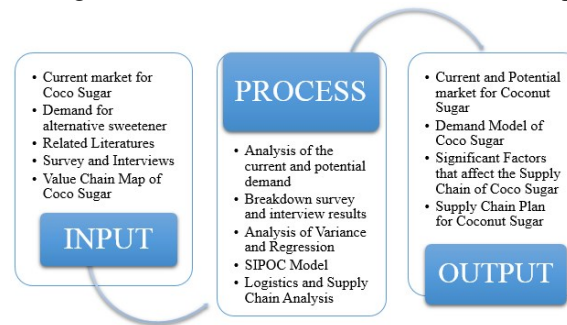


Figure 2. Conceptual Framework

Initially, data of the current and potential market for coco sugar were gathered in order to determine and predict the long term demand of coconut sugar in the study. Then, the researchers conducted a survey in order to identify the factors affecting the supply chain of coconut sugar. The questionnaires were administered to the key players of the supply chain namely the: sap collectors, processors and consolidators or traders. Afterwards, value chain map of coco sugar was also developed in order to fully understand the flow of activities involved in the coco sugar production, stake holders in coco sugar industry and other factors affecting the supply and demand of coco sugar.

Furthermore, in order to develop demand model for coco sugar, statistical tools were also used such as analysis of variance and regression analysis. And in order to establish supply chain plan for coco sugar, forecasting tool, SIPOC diagram, and logistics and supply chain management were employed.

The forecasting method used in this study was the trend line projection through the use of the regression equation from the current demand of the coco sugar. This helped the researchers in the analysis of different methods used in the processing of coconut sugar. Analysis of Variance (ANOVA) also helped the researchers in identifying processes that have significant difference to the price and production of the coco sugar. Regression analysis was also used to identify significant factors affecting the supply chain of coco sugar.

SIPOC Diagram was developed to determine the cost factors affecting the supply chain of coco sugar in terms of its suppliers, processes, outputs and customers. This primarily concerns the efficient integration of suppliers, factories, warehouses and stores so that merchandise is produced and distributed in the right quantities, to the right locations and at the right time, and so as to minimize total system cost subject to satisfying service requirements.

## 3. Results and Discussion

### 3.1. Result of Forecasting

The data on current market of coco sugar for the past three years (2010-2012) were gathered in order to forecast the future demand of coco sugar that will be used in the study. The data is presented in the figure below.

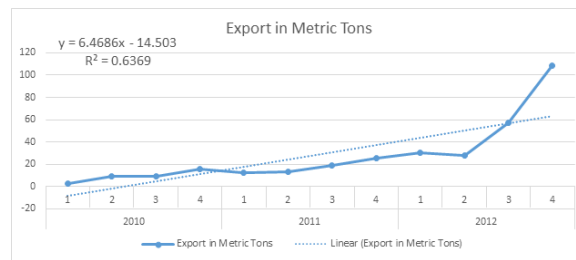


Figure 2. 2010-2012 Demand Data for Coco Sugar

The researchers used the trend line analysis to forecast the future demand of coco sugar in the study, the result of the y-intercept and slope of the line in the trend equation served as the basis for the researchers in computation of future demand.

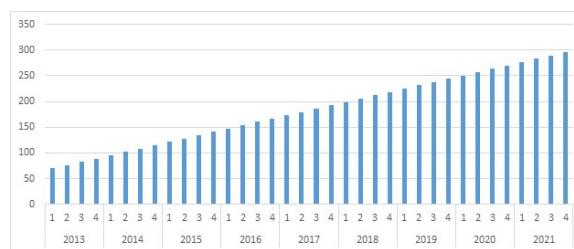


Figure 3. Result of Trend Forecast

The above figure shows the projected demand of the coconut sugar based on trend analysis of the three-period moving average forecast. By 2021, export demand of coconut sugar will increase to 295.99 metric tons. From the research study done by Quizon (2012), the prevalence of diabetes in the Philippines is becoming a big problem and an alternative sweetener like coconut sugar is recommended to be used. The health benefit of the product contributes essentially to the increase of its market potential. Most consumers of coconut sugar right now are the diabetics and the health enthusiast. Due to high prevalence of diabetics today, more people are switching to healthier alternative sweeteners. Based on the occurrence of diabetics nationwide, a projected demand is shown on the table below.

Table 1. Data on Diabetes Incidence, Sugar Consumption of Diabetics and Demand of Sugar

Year	Diabetes Incidence	Sugar Consumption of Diabetics based on RDI	Demand in MT
2016	4,219,000	548,470,000	548.47
2017	4,408,226	573,069,428	573.07
2018	4,605,940	598,772,165	598.77
2019	4,812,521	625,627,695	625.63
2020	5,028,367	653,687,723	653.69
2021	5,253,894	683,006,271	683.01
2022	5,489,537	713,639,785	713.64
2023	5,735,748	745,647,243	745.65
2024	5,993,002	779,090,268	779.09
2025	6,261,794	814,033,245	814.03
2026	6,542,642	850,543,451	850.54
2027	6,836,066	888,691,175	888.69
2028	7,142,691	928,549,863	928.55
2029	7,463,048	970,196,253	970.20
2030	7,797,773	1,013,710,525	1,013.71

The diabetes incidence is based on the present number of diabetics in the Philippines and the growth rate of diabetics based on World Health Organization. Sugar consumption is based on the recommended daily intake for diabetes 130g/day (Quizon, 2012). From here, the local demand was established.

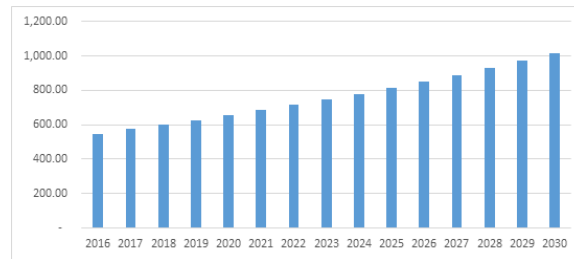


Figure 4. Data on Local Demand of Coco Sugar

The graph follows the historical increase of diabetic people annually specified by the World Health Organization for the Philippines. The recommended daily intake is 130g/day and the growth rate of the diabetics in the Philippines is at 4.4851%.

### 3.2. Result of Value Chain Analysis

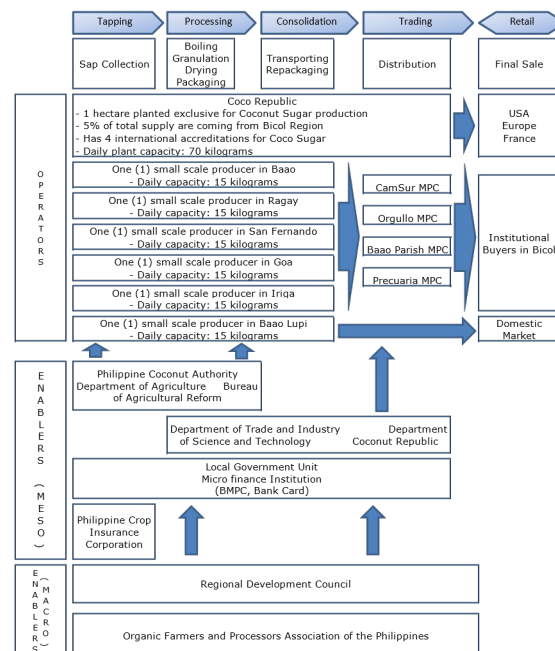


Figure 5. Current Value Chain Map of Coco Sugar

The figure 5 above shows the current value chain of coco sugar specifically in Camarines Sur. The value chain map shows the flow of raw materials going into processes and procedures in order to reach the market successfully. At present, Camarines Sur's biggest producer of Coconut Sugar which is the Coconut Republic, is only accommodating export demand. They believe that there is much potential on the international market than the domestic ones. Most clients of the small processors in the province are the institutional buyers in Bicol that buy in bulk and resell the products in Bicol and some in Metro Manila. As the supply chain of Coconut Sugar is established, the choke points of this value chain was identified and resolved. Key players of the supply chain of coco sugar is clearly seen in the figure. These are the sap gatherers, coco sugar processors, consolidators, traders and the retailers.

Table 2. Potential Coco Sap and Coco Sugar Supplier

Suppliers	No. of Farmers	Area Planted	Total No. of Trees	Coco Sap Supply	Coco Sugar Supply (MT)
BAAO Multipurpose Cooperative	26	78	5,766	2,594,700	371
RCDC, Ragay, Camarines Sur	35	81	7,795	3,507,750	501
Maymatan MPC, Goa, Camarines Sur	12	45	5,090	2,290,500	327

The cooperatives are the potential suppliers of coco sap and coco sugar in the province. Excluding the existing coco sap producers and processors, these cooperatives have great potential on the coconut sugar business. Based on the total area planted and number of coconut trees planted there, the Provincial Planning and Development Office estimated their sap supply and the corresponding coconut sugar supply of each organization. PPDO based their data on the initial years of operations of these organizations. A harvest of 1.5 liters of coco sap per day and an estimated 6 liters of coco sap will be able to be converted to kilogram of coconut sugar was assumed to achieve these numbers. If these organizations are persuaded to supply and process their coco sap, Camarines Sur will surely become a fast rising province for the coconut sugar industry.

Table 3. Processors of Coco Sugar

Processor	Production Capacity (kilograms)	Coco Sap Requirement (liters)	Market
Coco Republic	70	400	International Market
Baao Processor	15	120	Domestic Buyers
Ragay Processor	18	150	Domestic Buyers
San Fernando Processor	20	160	Domestic Buyers
Goa Processor	15	140	Domestic Buyers
Iriga Processor	15	120	Domestic Buyers
Lupi Processor	30	240	Domestic Buyers

The above table shows the production capacity and supply requirement of each Coconut Sugar processors together with its corresponding market. All home-based processors sell their products to domestic buyers particularly in Manila. Their finished products are sold on bulk to the consolidators.

The consolidators are in charge of transporting, repackaging and distribution of the finished products to its market. The province has four consolidators – CamSur MPC, Orgollo Bicol, BPMPC and Precuaria MPC. Coco Republic and Lupi do not depend on these consolidators but transports their products on their own. The figure below shows the list of the consolidators present in the province the corresponding processors and market they trade with.

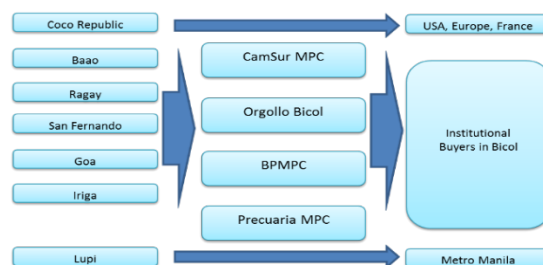


Figure 6. Consolidators in Camarines Sur

These consolidators gather all the finished products from the processors and are in charge of repackaging them for trading and selling. The consolidators are also the ones responsible on finding new retailers to trade with and keep in touch

with them. No formal agreement is guaranteed to and for the retailers by the consolidators. Weekly orders are processed by the consolidators.

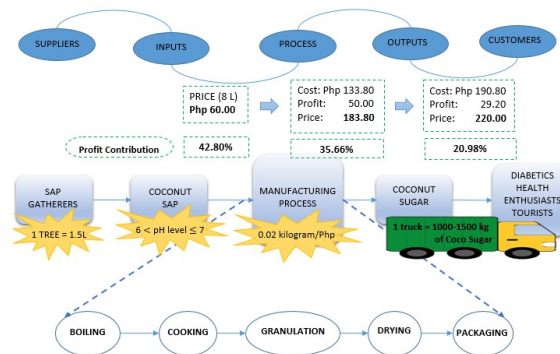


Figure 7. SIPOC Diagram

Based on the new and improved SIPOC diagram, the consolidators are now converted to processors making the price of coconut sugar lower. From a retail price of Php330.00, the new retail price is Php220.00. The new pricing was achieved by lowering the profit share of each player. This leads to a 33.33% decrease in the selling price of the coconut sugar making the product more attractive. In eliminating the consolidator, the cost of Php9.00 per kilogram was reduced.

Table 4. Cost Comparison

	Sap Collector	Processor	Consolidator	Retailer	
Cost		PHP 133.80	PHP 229.00	PHP 287.00	
Profit		PHP 86.20	PHP 51.00	PHP 43.00	
Price	PHP 60.00	PHP 220.00	PHP 280.00	PHP 330.00	
Cost		PHP 133.80	ELIMINATED	PHP 190.80	
Profit		PHP 50.00		PHP 29.20	
Price	PHP 60.00	PHP 183.80		PHP 220.00	
Production Cost		Consolidation Cost		Retailer Cost	
Coco Sap	60.00	Pack	2	Rental and Labor	7
Firewood	10.00	Transportation	7		
Water & Utilities	5.00				
Transportation	2.00				
Marketing	6.00				
Packaging	0.80				
Labor	50.00				

Table 5. Financial Supporters

Land Bank of the Philippines	Loan packages for small and medium industries
Bank Card	Provide financing to home-based processors
Coco Republic	Provide assistance to the new processors
Organic Farmers and Processors of the Philippines (OFPAP)	Provide much needed operating capital to its community members who do not have easy access to capital and bank loans

Department of Trade and Industry	Provide assistance to group of coconut farmers willing to engage in coco sugar production
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In eliminating the consolidators, financial support must be needed by the new and current processors and the organizations listed in the table above are capable of providing financial assistance to the consolidators that will be converted to processors. Also, the Coconut Republic will lead in the assistance needed by the processors on the production process. Warehouses of consolidators will be converted to production facility.

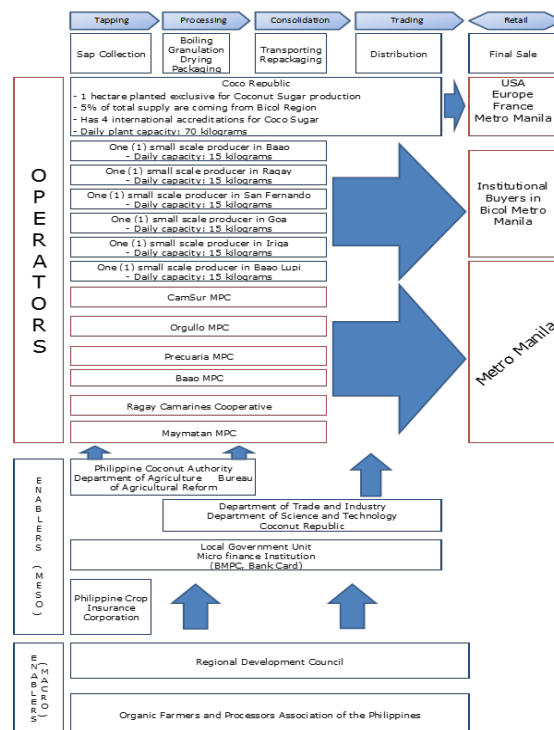


Figure 8. Recommended Value Chain Map of Coco Sugar

The new value chain map provided a more competitive price of coconut sugar which at the same time, gave a large profit contribution to all the key players. The consolidators are now converted to processors making the price of Coconut Sugar lower. From a retail price of Php330.00, the new retail price is Php220.00. The new pricing was achieved by lowering the profit share of each player. This leads to a 33.33% decrease in the selling price of the Coconut Sugar making the product more attractive. In eliminating the consolidator, the cost of Php9.00 per kilogram was reduced. This is 4.09% less of the selling price. The additional cooperative in the sap collection and processors were the former consolidators and the potential coco sap suppliers and processors. In eliminating the consolidators, financial support must be needed by the new and current processors and the organizations listed in the table above are capable of providing financial assistance to the consolidators that will be converted to processors. Also, the Coconut Republic will lead in the assistance needed by the processors on the production process. Warehouses of consolidators will be converted to production facility.

## 4. Conclusion

After thorough and intensive analysis, the researchers were able to conclude that the coconut sugar is a sustainable product for it has a high market potential and market growth. Due to promising market on diabetic prevalence, it is seen that coconut sugar will be a great substitute for the regular refined sugar and/or the muscovado sugar because of the health benefits it provides. Additionally, coconut sugar has already established its market internationally. The

growing export market will become an advantage to our country. On the other hand, statistical tools and analysis in the research study provided the significant factors that affect the price and productivity of coconut sugar. These are mainly the number of collections per day during sap collection, coconut sap supply for the processors and for the consolidators, the supply of coconut sugar has the greatest impact on the productivity. Planting more dwarf type of tree in the area of Bicol and other areas near Manila will help increase the supply of coconut sugar in Metro Manila. Proper knowledge in the coconut processing in order to utilize the materials effectively must be disseminated among the processors. These are the main focus of the supply chain and have to be developed in order to successfully introduce the coconut sugar industry to the market. The supply chain management plan aims to deliver coconut sugar to consumers wherever and whenever they want and need it. Increase in the number of consolidators is suggested and investors for this industry must be persuaded to fund the financial needs to be able to reach the primary market which is the Metro Manila. Also, there is a lack of endorsements and advertisement for the product that is why only few consumers are patronizing it right now. The retailers and processors must come up to marketing plan that will introduce coconut sugar to the market. Surely, the market growth of the product will be achieved once the supply chain plan for this industry is taken care of appropriately.

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