

Supply chain analysis of almaciga (*Agathis philippinensis* Warb.) resin in Governor Generoso, Davao Oriental, Philippines

Kharmina Paola A. Evangelista^{1*}, Canesio D. Predo¹, Rogelio T. Andrada II¹, Analyn L. Codilan¹, Vanessa M. Palma-Torres¹, Lawrence Adolph M. Amada¹, Margaret M. Calderon¹

¹Institute of Renewable Natural Resources, College of Forestry and Natural Resources, University of the Philippines Los Baños

*Email: kaevangelista1@up.edu.ph

ABSTRACT. The potential of almaciga resin as a source of livelihood for several indigenous communities in the Philippines continues to grow as the demand for processed resin escalates. Almaciga resin is utilized mainly by local industrial manufacturers of paints, varnishes, lacquer, and ink. While reports have shown steady growth in the paints and varnish industry, many resin producers in the country remain poor and dependent on agriculture as their primary source of income. Davao Oriental is among the regions in the country where almaciga trees are abundant. This paper examined the supply chain of almaciga resin in Governor Generoso in Davao Oriental, Philippines, to determine inefficiencies along the chain and provide recommendations to improve the lives of the indigenous communities through resin tapping. Resin tappers belonging to the Lumad Almaciga Tappers Association of Governor Generoso (LATAGG), a group of indigenous peoples granted permits to harvest almaciga resin, were interviewed. From there, the rest of the supply chain actors were traced. The supply chain of almaciga resin in Governor Generoso is simple and organized, with four key actors: the resin tapper, local buyer, assembler, and an industrial buyer in Cebu. Each actor performs specific activities. An analysis of the price and profit margins of these actors revealed that the resin tappers incurred a negative profit margin of 42% at the current price of US\$ 0.39 kg⁻¹ and a negative price margin of US\$ 0.17 kg⁻¹ if the opportunity cost of time is added to the material cost. Market inefficiencies included (1) the undervaluation and underpricing of the almaciga resin as the lone buyer has set the price and (2) market information asymmetry, putting the resin tappers at a losing end as they have little idea about the value of their products beyond the price paid.

Keywords: forest-based livelihood, Manila copal, market inefficiencies, non-timber forest product, resin tappers

INTRODUCTION

Non-timber forest products (NTFPs) have been an alternative source of income in most upland communities in the Philippines. Almaciga resin is among the NTFPs considered important dollar earners of the country (Razal 2013). As early as the 19th century, the Philippines has been exporting almaciga resin, commercially known as Manila copal, to the United States. While almaciga (*Agathis philippinensis*) thrive in many parts of the country, the main sources of resin

recorded in the Philippine Forestry Statistics (PFS) were Regions 4A, 4B, and 8 (Forest Management Bureau n.d.). Davao was one of the early sources of Manila copal from the Philippines, with 50% of total exports coming from the province, according to Richmond (1910), as cited by West & Brown (1920). Locally, almaciga resin is used as incense in religious ceremonies, fire starters, and caulking boats. Industries use the resin in the manufacture of varnishes,

paints, soaps, plastics, printing ink, shoe polish, floor wax, and in making patent leathers and sealing wax, among other things (West & Brown 1920; Ella *et al.* 2011).

The involvement of the local government unit of Governor Generoso in almaciga resin tapping started with a tourism project in 2006 when the municipality was identified as a potential site for tourism mainly because of its scenic waterfalls. The project's target beneficiaries were the indigenous communities belonging to the Lumad Almaciga Tappers Association of Governor Generoso (LATAGG) living in the uplands of the municipality. Among the problems identified were related to LATAGG's main source of income, which is agriculture. This prompted the LGU officials to look at the potential of almaciga resin as an alternative source of income for the community. The region, specifically the municipality of Governor Generoso, took part in the Biodiversity Partnership Program (BPP) of the Department of Environment and Natural Resources (DENR). They started celebrating its annual Almaciga Festival in 2008, which aimed to increase environmental awareness and promote the protection and preservation of the town's threatened natural resources, particularly almaciga (Duallo 2008). Various projects have been implemented in Davao Oriental to support the growth potential of almaciga resin as a secondary source of income for the indigenous people. The BPP provided community training on proper resin tapping. Also, Governor Generoso with support from the USAID Protect Wildlife, hosted the indigenous almaciga tappers from Palawan in 2016 as part of its efforts to scale up biodiversity-friendly livelihoods. The Palawan tappers observed how local tappers in Governor Generoso tapped and harvested resin while avoiding tree damage. The local government of Governor Generoso also shared its sustainable management practices that include regulating tapping schedules and the volume of resin to be harvested (San Diego 2016).

Despite its potential, Davao's contribution to almaciga resin production in the Philippines has not been reported in the PFS since 2012. To get a full understanding of the flow of almaciga resin supply from Governor Generoso and know the key actors involved in the almaciga resin industry in the area, a comprehensive assessment of the almaciga resin supply chain was conducted.

METHODOLOGY

The supply chain analysis was done by tracing the flow of almaciga resin supply from the resin tappers to the resin buyer. Thirty-one resin tappers belonging to LATAGG were interviewed using a survey questionnaire. LATAGG is a group of indigenous peoples granted permits to harvest almaciga resin. The sampling method used for the tapper

survey was snowball sampling, where respondents were chosen based on the local expert's recommendation and the availability of respondents. Key informant interviews (KIIs) with middlemen, DENR personnel, local government unit representatives, and other informants were conducted to complete the supply chain. Secondary data from published literature, reports, and statistics on almaciga resin were gathered to support the primary data. Profit margins, costs incurred, and activities performed at each level were then analyzed, and market inefficiencies along the chain were determined.

The study was conducted in the municipality of Governor Generoso, a second-class municipality among the ten (10) municipalities of the province of Davao Oriental in Region 11 (Davao Region). The municipality's total area is 36,575 ha, some of which form part of the Mount Hamiguitan Range Wildlife Sanctuary (UNESCO n.d.). Its elevation ranges from 2 to 941 m asl, while its slope extends up to 72 degrees. Governor Generoso comprises 20 barangays, of which six are involved in almaciga resin tapping: Oregon, Sergio Osmeña, Surop, Tandang Sora, Tiblawan, and Upper Tibanban. The municipality was once called Sigaboy because of the abundance of almaciga trees in the area, the resin of which was used to light torches. **Figure 1** shows a map of Governor Generoso and the 6 barangays engaged in almaciga resin tapping and the proximate location of almaciga stands. Most of the almaciga stands in the study sites can be found within mountainous areas with rolling to gently rolling slopes. Some of the areas are within the Mt. Hamiguitan Range Wildlife Sanctuary.

RESULTS AND DISCUSSION

The supply chain of almaciga resin from Governor Generoso is simple and organized. **Figure 2** shows the geographic flow of almaciga resin from the tappers to the final user. There are four key actors in the almaciga resin supply chain in Governor Generoso – the resin tapper, local buyer, assembler, and industrial buyer.

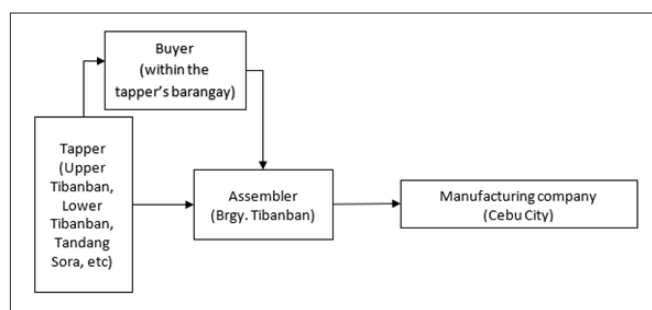


Figure 2. The geographic flow of almaciga resin from Governor Generoso, Davao Oriental.

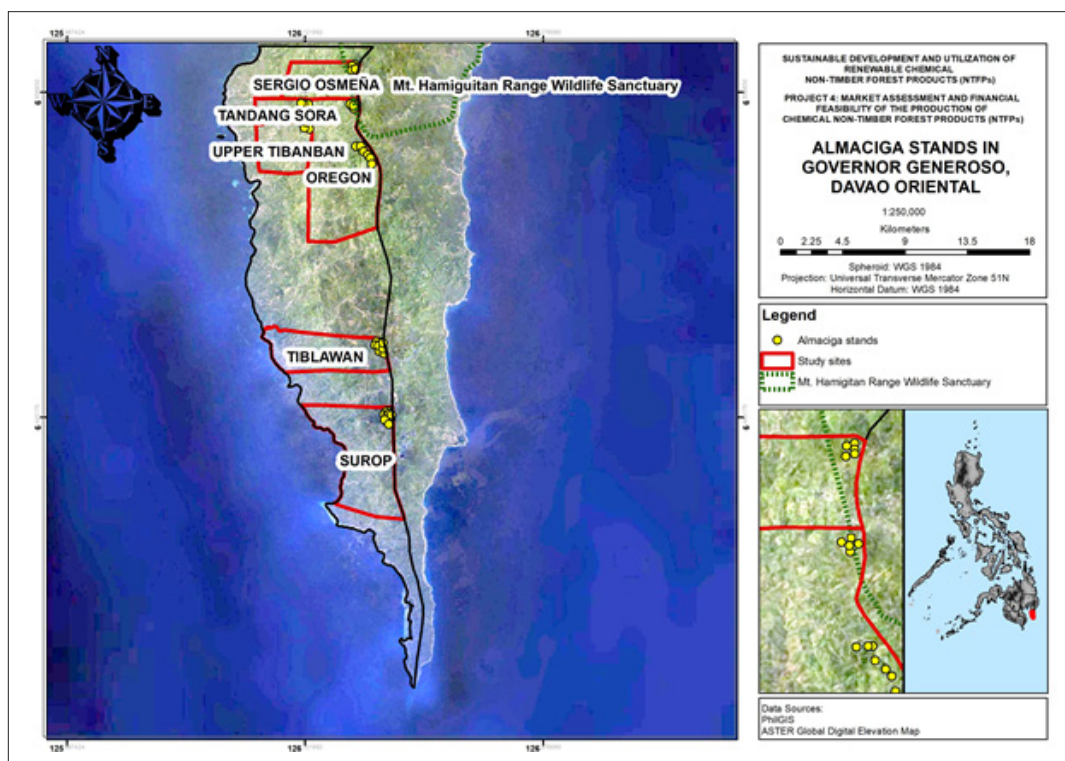


Figure 1. Study site map of almaciga resources in Governor Generoso, Davao Oriental.

Resin tappers

The resin tappers of Governor Generoso belong to LATAGG. The group consists of 122 members, and the interviewed respondents came from Brgys. Sergio Osmeña, Tiblawan, Kangkaling, Surop, and Oregon. Their sociodemographic profile is summarized in **Table 1**.

The average income of the respondents is USD 455.19 yr^{-1} or USD 37.93 mo^{-1} , inclusive of income coming from resin tapping and farming. This is below the per capita income computed for Davao Oriental in 2012 at USD 620.40 yr^{-1} since the interview was conducted in rural areas where poverty incidence is high. Based on the survey, 83.9% of the respondents do farming, while 3.23% do off-farm activities and were employed.

The roles of resin tappers in the supply chain are tapping almaciga trees, harvesting resin from trees, transporting the resin from the tapping site to the storage area, and cleaning resin. Governor Generoso tappers travel an average of 3.15 hours by foot to get to the almaciga trees. Travel time among respondents ranged from 0–12 hours. Each tapper in the municipality is assigned 150–200 trees, mostly more than 20 years of age, with a minimum height of 18 ft. Only trees with a minimum diameter at breast height (dbh) of 30 cm were tapped. Resin tapping is done an average of 64 times a year, with the majority of the respondents harvesting resin once a month. On average, a tapper harvests 101.51 kg mo^{-1} .

About 32.26% of the respondents did not observe peak or lean season in resin production. Some observed better yield from March to June, while others said it was from July to December. Based on the interview, 38.7% of the respondents mentioned that they harvested less resin during the rainy season not because of the trees exuding less resin but because of the difficulty of the terrain going to the almaciga stands. Other factors affecting the volume of resin harvested included theft (16.13%), tree age (12.9%), tapping method (9.68%), extreme heat (9.68%), and wind (6.45%).

Among the challenges faced in harvesting resin were the lack of tools and equipment, heavy rains, the occurrence of pests, lack of capital, and the distance needed to travel to get to the almaciga trees and back to the storage area with one to two sacks of resin on their backs.

Table 2 summarizes the costs of inputs used in resin tapping by the tappers. The major inputs were bolo, sack, plastic sheet, and hired labor for harvesting and transporting resin. The computed costs were rough estimates since some respondents improvised their tools and materials to reduce costs. About 53.97% of the total costs of tappers were spent on plastic sheets. These sheets are placed on the tapped trees trunks to catch the chipped-off resins to minimize impurities that can affect the performance of the melting machine used by the industrial buyer.

Table 1. Sociodemographic characteristics of respondents in Governor Generoso, Davao Oriental.

Characteristic	Value
Sex (%)	
Male	67.7
Female	32.3
Age range	15–70
Ethnicity (%)	
Manobo	29.03
Davaweño	6.45
Lumad	12.9
Mandaya	12.9
Others	32.36
Civil status (%)	
Single	25.8
Married	71
Live-in	3.2
Education level (%)	
None	9.7
Elementary level	67.7
Elementary graduate	12.9
Highschool level	9.7
Average annual income (USD)	455.19
Source of income (%)	
Farm	83.9
Off-farm	3.23
Employment	3.23

Aside from harvesting and transporting activities, 32.26% of the resin tappers clean the harvested resin before the buyer or assembler picks it up. Cleaning lasts an average of 7.55 hours depending on the volume harvested, which ranges from 30–350 kg. Only one respondent was reported to do the sorting. The tappers sell clean and whole resins to their buyer and personally use dirty and pulverized resins for torches and starting a fire. About 38.71% of the respondents repack resins that last an average of 2.55 hours. Some of the challenges encountered by the tappers in post-harvest activities were the lack of tools and equipment, poor access to technology, lack of knowledge on proper techniques, lack of capital, and climate-related challenges.

About 87.1% of the respondents sell directly to one local assembler who transacts with the industrial buyer. The remaining 12.9% of the respondents sell their harvests to a local wholesaler, who then sells the resins to the local assembler. The wholesalers earn USD 0.04 per kg buying resin from the tappers at USD 0.37 kg⁻¹ and selling it at USD 0.42 kg⁻¹ to the local assembler. The buying price of the industrial buyer is fixed at USD 0.42 kg⁻¹. Hence, if a tapper chooses convenience or needs cash, he or she would have to sell at USD 0.37 kg⁻¹ so the buyer can then to the industrial buyer at USD 0.42 kg⁻¹.

About 35.48% of the respondents deliver the harvest to their immediate buyer, while the rest have their harvests picked up by the immediate buyer. The main challenge encountered by the respondents was the low buying price of resin, with 29.03% of the respondents citing it as one of the challenges. This buying price is much lower than the resin price coming from Palawan, mainly because of the difference in quality. The LGU of Governor Generoso is looking for ways to improve resin solubility to increase the price.

Other problems encountered include the distance from the tapping site to the storage area to the buyer, selling to only one buyer, liquidation of payment, and transportation cost.

Table 2. Average costs incurred in tapping and harvesting per tapper per year in Governor, Generoso, Davao Oriental.

Inputs	Description of use	Quantity per year	Unit	Unit cost (USD)	Amount (USD)	Percentage to total (%)
Bolo	Used in tapping the tree and chipping off the resin	1	pc	5.30	5.30	4.25
Sack	Used in hauling resin from the tapping site to storage area	24 (Assumption: average harvest mo ⁻¹ is 101 kg and 1 sack can contain 50 kg)	pc	0.87	20.94	16.79
Plastic sheet	Used to catch the resins chipped off from the tree	162	pc	0.42	67.31	53.97
Labor	For harvesting and transporting	6	Man-days	5.19	31.16	24.99
Total					124.70	

Cost kg⁻¹ (USD) = 0.10

Assembler

There is only one assembler in the municipality, a local government officer assigned to manage the local almaciga resin industry. The local assembler does not function as a trader who makes a profit from buying and reselling resin. Instead, he collects almaciga resin harvested from areas covered by the LATAGG members every Saturday. The collected resins are assembled and prepared for transport to Cebu in a rented storage area in the town proper. He then ships five to eight tons of resin per month to the industrial buyer from Cebu at the same price he pays the resin tappers or local wholesalers per kilogram of resin. This has been the price of resin since 2015. **Table 3** shows the costs incurred in each activity done by the assembler. However, it should be noted that the industrial buyer shoulders all costs.

Table 3. Costs in assembling almaciga resin in Governor Generoso, Davao Oriental shouldered by the industrial buyer.

Cost item	Estimated cost (USD) per unit time
<i>Investments</i>	
Weighing scale	249.28
Transportation (Jeepney)	1454.14 bought in 2017
<i>Operation costs</i>	
Transportation cost in collecting resins (Labor, gas, food)	41.55 mo ⁻¹
Bodega rental	62.32 mo ⁻¹
Jeepney maintenance	207.73 yr ⁻¹
Permit to harvest	415.47 yr ⁻¹
Reweighing and repacking in sacks (Labor)	31.16 mo ⁻¹ , twice a month
Sacks (PhP 13 sack ⁻¹ ; 180 sacks used for 8 tons)	48.61 for 8 tons
Monitoring costs (where CRU visits the site every month)	103.87 mo ⁻¹
Container van and shipping fee	581.66 for 8 tons
Trucking	124.64 for 8 tons
Transportation cost in shipping resin (Labor)	124.64 per trip
Permit to transport/ Forest charge (DENR)	0.03 kg ⁻¹
Fee paid to the barangay	0.01 kg ⁻¹
Fee paid to the federation	0.01 kg ⁻¹
Fee paid to the LGU	0.01 kg ⁻¹
Total operation cost per year (a)	17,285.13
Total operation cost per month (b)	1,440.43
Cost kg ⁻¹ (b/8,000)	0.18 plus buying price of 0.42 = USD 0.60 kg ⁻¹

The activities done by the assembler include collecting resins from tappers, reweighing, repacking in sacks, monitoring, arranging the transport of resin from the bodega to Davao port, and shipping from Davao port to Cebu port. The assembler also arranges the permit application of LATAGG and the permit to transport from DENR. Sorting was mentioned, but they only separate the dirty resin from the clean resin. The dirty ones are not sold.

Industrial buyer

Currently, there is one buyer of resin from Governor Generoso. The paints and varnish manufacturing company started buying from the municipality in 2012 as they needed more resin supply for their operations. It also buys resin from Brooke's Point and Rizal in Palawan for USD 0.73 kg⁻¹. They also import from Indonesia at a price lower than USD 0.42 kg⁻¹. Because the resin from Governor Generoso exhibited lower solubility than the resin from other sources, the company had to invest in a melting machine. This commanded a lower price of USD 0.42 kg⁻¹ compared to the price they paid to other sources. The company communicates directly with the local assembler and funds all related activities.

Unfortunately, the company's privacy concerns limit access to information, particularly the business relation with Governor Generoso. According to secondary sources, the company is a paint and solvent manufacturing company established in Mandaue City, Cebu in 1975. According to Global Suppliers Online, products include emulsion paints, hydrochloric acid, coconut charcoal briquettes, gum copal, solvents, handicraft items, rubber cup lump, and tongkat ali (*Eurycoma longifolia* Jack).

The company started production of coatings and solvents in 1995 when the sales of its main product, floor wax, started to decline. In 2005, it began exporting gum copal, and is now one of the most respected businesses in terms of quality and pricing in the country. Currently, the company has an annual output value of USD 2.5 M – USD 5.0 M coming from more than 10 product lines, of which 51–60% is earned through exports (Sell123.org 2014).

Price margin and profit margin

Table 4 summarizes the profit margin each actor in the chain earns. While resin tappers have a high-profit margin, it should be noted that opportunity costs and difficulty of harvesting the resins were not accounted for. This difficulty limits the amount of resin harvested by each tapper. On average, a tapper can harvest 1,218 kg yr⁻¹. If they sell directly to the assembler, they will only earn USD 506.04 yr⁻¹ or roughly USD 1.39 day⁻¹. They could have earned USD 5.19–6.23 day⁻¹ working as hired farm laborers. The opportunity cost incurred by each tapper was computed based on the average number of hours spent traveling to and from the tapping site.

Table 4. Profit margin of each key actor in the supply chain of almaciga resin (Manila copal) in Governor Generoso, Davao Oriental.

Supply chain actor	Average material costs incurred kg ⁻¹ (USD kg ⁻¹)*	Material costs plus opportunity cost (USD kg ⁻¹)	Average selling price (USD)	Average price margin (USD kg ⁻¹)		Profit margin (%)	
				w/o OC	w/ OC	w/o OC	w/ OC
Resin tapper	0.10	0.56	0.39	0.29	(0.17)	74.05	(42.32)
Local buyer	0.37	-	0.42	0.04	-	10	-
Assembler	None	-	0.42	0	-	0	-
Industrial buyer	0.60	-	n/a	n/a	-	n/a	-

*Opportunity cost was computed based on the distance traveled by the tappers from their house to the tapping site and back (Tapulao 2020)

Without considering the opportunity cost, the tappers seem to be earning more than enough given the direct material costs incurred at USD 0.10 only. In this scenario, the price margin is USD 0.29 kg⁻¹, and the profit margin is 74.05%, which is way higher than the profit margin earned by the local buyer. However, if the opportunity cost is added to the material cost, the tappers will have a negative profit margin of 42.32% at a negative price margin of USD 0.17 kg⁻¹. Tappers are at the losing end when the time-consuming and back-breaking process of tapping and harvesting resin are accounted for.

Almaciga resin can be exported at USD 2.49 kg⁻¹, higher than the farmgate price of USD 0.39 kg⁻¹ considering that the only value-adding process done was refining. The tappers are shortchanged, given the difficult process in getting the resin. In addition to the regulations and permit-related inefficiencies, this process limits the volume sold. This is why to this day, resin tappers are still considered poor, and the potential of almaciga resin as a source of income of the IP community has not been fully realized.

The four key actors in the supply chain of almaciga resin in Governor Generoso each play an important role in sustaining the almaciga resin industry in the region. Among the four actors, the resin tappers mostly depend on the success of the industry. While they invest less financial capital, they devote significant time and effort to ensure the raw material's sustainable supply and provide food for their families. Meanwhile, local buyers have more stable sources of income other than trading resin and thus are less dependent on the profit earned from resin. However, their role in the supply chain is crucial in helping the local assembler collect resin more efficiently (*i.e.* avoiding collection from individual tappers) and assisting resin tappers dispose of their harvest and earn immediate cash. As the mediator between the resin tappers and industrial buyers, the local assembler receives the most information about the market. While it is beneficial for the buyer and seller that the local assembler does not get any fraction of the value of the resin, the lack of incentive in participating in business may affect the long-term sustainability of the industry. Another

key issue limiting the market growth of the resin industry in Governor Generoso is the municipality's debt of gratitude to the industrial buyer. After being rejected by a different manufacturing company back when Governor Generoso was exploring the market for almaciga resin, the current industrial buyer allowed the community to sell their resins despite the relatively lower solubility properties of the resin. This formed a debt of gratitude among tappers and local assemblers making the industrial buyer the exclusive buyer of resin. The local assembler is exploring other tapping sites in Davao Oriental to cater to the demand of other potential buyers.

Market inefficiency

One of the observed market inefficiencies in the almaciga resin supply chain in Governor Generoso is underpricing or undervaluation of the resource. This can be attributed to the information asymmetry observed in the supply chain, worsened by the resin tappers' remote location. As mentioned earlier, almaciga resin can be exported at a price as high as USD 2.49 kg⁻¹, and yet the buying price of resin from Governor Generoso has remained at USD 0.39 kg⁻¹ since 2015. Based on the interviews, the resin tappers do not negotiate prices with the buyer and only account for the material costs incurred. The lack of information about the value of the resin hinders the resin tappers from evaluating the product quality of their product hence, the market system failed to produce just prices (Barbaroux 2014; Waseem *et al.* 2008).

On the other side of the chain, the buyer may be unaware of how difficult it is to harvest a kilo of resin and base the buying price on costs alone, disregarding the intangible costs incurred by the resin tappers. According to the key informant in Governor Generoso, the company said that they could no longer increase the resin price because approximately USD 0.58 kg⁻¹ of resin were spent, including the storage and transportation costs it shoulders. The price of USD 0.42 kg⁻¹ does not even cover the entire opportunity cost computed at USD 0.56 kg⁻¹, which was based on the distance traveled by the tappers plus the cost of the material. The unfair pricing

can also be related to the lack of sorting or grading of resin in Governor Generoso. In Palawan, almaciga resin is priced based the resin class, the cleaner, and the bigger the resin, the higher the price.

CONCLUSION AND RECOMMENDATIONS

This study examined the supply chain of almaciga resin in Governor Generoso, particularly the key actors in the supply chain, the activities performed by each actor, price and profit margins incurred, and market inefficiencies along the chain. The study aimed to help the almaciga resin industry in the municipality, specifically the poor resin tappers dependent on agriculture as their main source of income.

Almaciga resin as an industrial good shows great promise as an alternative source of income for the upland communities of Davao Oriental. The almaciga resin industry in Governor Generoso greatly benefitted from the support of its local government unit as it helped jumpstart the local almaciga resin industry in the province (Olvida 2019). In the Philippines, the local government units (LGUs) play a crucial role in the success of small-scale enterprises, especially in the rural areas where people are less capable technically and financially. LGUs are a significant part of the Sustainable Livelihood Program of the country led by the Department of Social Welfare and Development (Acosta & Avalos 2018).

However, despite the strong LGU support, the almaciga resin industry in Governor Generoso still faces several issues. The demand for resin from the municipality remains limited due to the inferior quality (*i.e.* only 75% soluble compared to 95% solubility of resin from Palawan) and the prevailing culture of debt of gratitude municipality to the industrial buyer. Because of this, Governor Generoso has been serving one industrial buyer for over 10 years. The monopsonistic nature of the market structure of the almaciga resin industry in the site puts downward pressure on price, which means that the longer the supply chain gets, the lower the price at the tapper's level will be (EconomicsOnline 2020). The long distance from the tappers to the assembler forces some tappers to add another actor in the chain, thus reducing the selling price by USD 0.04 kg⁻¹. The local government is looking for ways to improve further the quality of its resin by exploring other sources in the region and looking into acquiring its melting machine to demand a higher price.

Nonetheless, there is still market distortion and information asymmetry observed on-site as the opportunity cost of harvesting resin from far-flung areas was not accounted for in the buying price, hence underpricing of resin (Barbaroux 2014).

Despite the low buying price of resin, the supply chain system in Governor Generoso appeared to be more organized compared to most NTFP systems observed in the country (Cerio 2018; Cimatu 2012; USAID 2006). The assignment of trees per PO member also helps regulate tapping practices and prevents conflict among resin tappers. The active participation of the local government resulted in a more organized system with only one local assembler collecting resin from the tappers and local wholesalers. The government plays an important role in promoting sustainable supply chain management practices, *e.g.*, through the laws and regulations (Wu *et al.* 2018). Furthermore, supply chain actors receive assistance from the government in the form of access to farm-to-market roads, financial support, price monitoring, training programs, and access to market information, among others. These are crucial in minimizing market inefficiencies in the supply chain (Librero & Tidon 1996). Moreover, permit application is not a problem because the local government assists the PO in securing permits to harvest resin. The local government plans to include more municipalities in their almaciga resin project, which could attract more buyers.

Based on the results of the study, the following recommendations are presented:

1. The LGU of Governor Generoso may partner with the Department of Science and Technology (DOST) to acquire the melting machine it needs to produce better quality resins. In this way, tappers can demand a higher price and increase their competitive advantage. DOST has a Small Enterprise Technology Upgrading Program (SETUP), which encourages small enterprises to adopt technological innovations to improve products and operations (DOST-NCR n.d.).
2. The provincial government of Davao Oriental must coordinate with the DENR to be officially recognized as one of the producers of almaciga resin in the country, especially since the Philippine Forestry Statistics has been reporting Palawan as the sole source of resin in the country.
3. A local market forum may help eliminate the market information asymmetry between resin producers and buyers. Through this forum, buyers will appreciate the value of almaciga resin more by knowing the difficulty of harvesting resin that tappers typically experience. This may promote the development of social enterprises among industrial buyers of almaciga resin and inclusion of the tapper's opportunity cost from resin-tapping in the buying price.

ACKNOWLEDGEMENTS

The authors would like to thank the Department of Science and Technology (DOST) and the Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD) that provided funding for the project “Market Assessment and Financial Feasibility of the Production of Chemical Non-Timber Forest Products (NTFPs),” under which this study was undertaken.

LITERATURE CITED

- Acosta, P.A. & Avalos, J. (2018) *The Philippines Sustainable Livelihood Program: Providing and Expanding Access to Employment and Livelihood Opportunities (No. 13)*. The World Bank. Retrieved from: <<https://documents1.worldbank.org/curated/en/385601527673449057/pdf/The-Philippines-Sustainable-Livelihood-Program-providing-and-expanding-access-to-employment-and-livelihood-opportunities.pdf>>
- Barbaroux, P. (2014) From market failures to market opportunities: managing innovation under asymmetric information. *Journal of Innovation and Entrepreneurship* 3(5). <https://doi.org/10.1186/2192-5372-3-5> Retrieved on 9 January 2022 from: <<https://innovation-entrepreneurship.springeropen.com/articles/10.1186/2192-5372-3-5#citeas>>
- Cerio, C.T. (2018) Women behind the thatch: an analysis of the nipa (*Nypa fruticans*) thatch making community in Lagonoy, Camarines Sur, Philippines. *International Journal of Research in Economics and Social Sciences* 8(1): 631–642.
- Cimatu, F. (2012) *Bamboo Value Chain* [Slides]. Slide Share. Retrieved from: <<https://www.slideshare.net/frankcimatu/bamboo-value-chain>>
- DOST–NCR [Department of Science and Technology–National Capital Region]. (n.d.) *Small Enterprise Technology Upgrading Program*. Retrieved on 26 May 2021 from: <https://ncr.dost.gov.ph/program_setup.php>
- Duallo, N.D. (2008) *Archives: Philippine Information Agency*. Retrieved from <<http://archives.pia.gov.ph/?m=12&sec=reader&fi=p080814.htm&no=05>>
- EconomicsOnline. (2020) *Monopsony Power*. Retrieved from: <https://www.economicsonline.co.uk/business_economics/monopsony_power_and_remedies.html>.
- Ella, A.B. & Domingo, E.P. (2011) Almaciga (*Agathis philippinensis* Warb.): Valuable but endangered forest tree species in the Philippines. *Multinational and Transboundary Conservation of Valuable and Endangered Forest Tree Species* (pp. 75–78). Asia and the Pacific Workshop. International Union of Forest Research Organizations.
- FMB [Forest Management Bureau]. (n.d.) *Philippine Forestry Statistics*. Retrieved on 26 May 2021 from: <<https://forestry.denr.gov.ph/index.php/statistics/philippines-forestry-statistics>>
- Global Suppliers Online. (n.d.) C.R.U. International Corporation | Philippines. Retrieved on 26 May 2021 from: <<https://globalsuppliersonline.com/supplier/Cru-International-Corporation?id=419517&txtsrch=Chemicals&match=HJHGgfjHKJhjt>>
- Librero, A.R. & Tidon, A.G. (1996) *Marketing of Agricultural Commodities by Producer Groups in the Philippines* (Book Series No. 158 ed.). Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development and International Development Research Center. ISBN 971-20-0439-2 Retrieved on 9 January 2022 from: <<https://idl-bnc-idrc.dspacedirect.org/bitstream/handle/10625/22022/113022.pdf?sequence=1>>
- Olvida, C.V. (2019) *Opportunities and Challenges in Implementing Forestry Livelihoods in Forest Landscape Restoration*. International Conference on Forest Landscape Restoration, Makati City, Philippines. Retrieved from: <https://flr2019.weebly.com/uploads/1/2/2/9/122916722/4_olvida_casimiro.pdf>
- Razal, R.A., Maralit, A.A., Colili, N.B., Alsa, L.N., & Canlas, R.P. (2013) *Value chain study for almaciga resins*. Non-Timber Forest Products Task Force.
- San Diego, L. (2016) *Palawan Partners Learn Sustainable Harvesting of Almaciga Resin in Davao*. Retrieved 26 May 2021 from: <<https://fasps.denr.gov.ph/oldsite/index.Php/2016-02-17-04-17-37/news-info/260-palawan-partners-learn-sustainable-harvesting-of-almaciga-resin-in-davao>>
- Sell123.org. (2014) C.R.U. International Corporation, Philippines, Manufacturer, Distributor/Wholesaler, Sell123.org. Sell123.Org Global Suppliers. Retrieved on 26 May 2021 from <<http://www.sell147.com/company/Philippines/1508156.htm>>
- Tapulao, R.R. (2020) Harvesting practices and pricing strategy of almaciga resin in Governor Generoso, Davao Oriental, Philippines. *Unpublished Undergraduate Thesis*. University of the Philippines Los Baños.
- UNESCO [United Nations Educational, Scientific and Cultural Organization] (n.d.) *Mount Hamiguitan Range Wildlife Sanctuary*. Retrieved on November 2020 from: <UNESCO: <https://whc.unesco.org>>
- USAID [United States Agency for International Development]. (2006) *Philippines Rattan Value Chain Study*. Retrieved on 9 January 2022 from: <<https://www.yumpu.com/en/document/read/37143332/philippines-rattan-value-chain-study-about-the-philippines>>
- Waseem, A., Roland, D., & Al-Squri, M.N. (2008) Information asymmetry and product valuation: an exploratory study. *Journal of Information Science* 35(2): 192–203. Retrieved on 9 January 2022 from: <<https://journals.sagepub.com/doi/abs/10.1177/0165551508097091?journalCode=jis>>
- West, A.P. & Brown, W.H. (1920) *Philippine Resins, Gums, Seed Oils, and Essential Oils*. Bureau of Printing.
- Wu, J., Zhang, X., & Lu, J. (2018) Empirical research on influencing factors of sustainable supply chain management—Evidence from Beijing, China. *Sustainability* 10(5): 1–12. <https://doi.org/10.3390/su10051595>