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Comparative advantage of almaciga resin production in Palawan and Davao Oriental, Philippines

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ABSTRACT. The paper investigates the profitability and comparative advantage of resin tapping in San Vicente and Brooke's Point in Palawan and Governor Generoso, Davao Oriental, from the tappers' viewpoint and the industry's competitiveness in the international market. Cost-return and comparative advantage analyses were undertaken, and the Domestic Resource Cost Ratio (DRCR) was derived through the policy analysis matrix (PAM). Results show that almaciga resin production among tappers is highly profitable from financial and economic perspectives due to relatively low input resource costs. Based on shadow prices, the DRCR values for all sites are less than unity, showing that almaciga resin production at current prices has a comparative advantage and is competitive in the international market. The PAM results show that almaciga resin production using a fair price that accounts for the tappers' opportunity cost of time is highly profitable from the private and social viewpoints. With the increased fair private price and economic price, DRCR estimates are higher than the values obtained at the current price situation for all sites. Nevertheless, all DRCR estimates are still less than unity, implying that imposing a fair price policy at the farm gate level will still make almaciga resin production competitive in the international market. Adjusting further the world prices being higher under the shadow exchange rate (SER), domestic almaciga resin still exhibits a comparative advantage, as seen in the DRC/SER ratio of less than one for all sites. The results can provide more evidence-based guidance for policy measures toward fair pricing for almaciga resin in the Philippines.

Keywords: *Agathis philippinensis*, domestic resource cost ratio, Manila copal, non-timber forest product, policy analysis matrix, profitability

INTRODUCTION

Almaciga is a premium wood species in the Philippines that has earned this status because of its high-quality wood and the hard resin it produces, known as copal. It is a tropical conifer, a characteristic shared by its cousins under the genus *Agathis* of the family Araucariaceae. Manila copal is the trade name for a hard resin originating from tree species belonging to the genus *Agathis*. Manila was once the most important port of export, where the first shipment of almaciga resin came from. Hence, the name 'Manila copal[1]' (West & Brown, 1920).

Among the well-described sources of Manila copal are *Agathis alba* Foxw. and *Agathis philippinensis* Warb. It is part of a family of resins produced in different regions worldwide, named after the geographic location

1 In this paper, almaciga resin and Manila copal are used interchangeably

from which it is produced (CIFOR n.d.). The almaciga resin is extracted from the tree's bark along the main trunk, but in some islands in Southeast Asia, even large branches are tapped. The resin starts as a clear or translucent sap that eventually solidifies as it meets air and over time. The hardened resin takes on a range of hues from yellowish to dark brown.

As a substance, Manila copal is characterized as having a high melting point, soluble in alcohol but insoluble in petroleum-based solvents (Mantell, 1937). The chemical makeup of Manila copal renders it an important ingredient in producing "incense in religious ceremonies; for caulking boats; as a fumigant against mosquitoes; in the form of a spirit solution as a substitute for shellac in the manufacture of high-grade glossy varnish, lacquer, road paint (Whitmore, 1980), linoleum, waterproofing, paper print ink (Mantell, 1937), in the manufacture of soap (Zamora & Co, 1986), pesticides, wax, polishing material, and photogravure (pcaarrd.dost.gov.ph).

The export of almaciga resin can be traced back to as early as the 1900s during the American period when the Philippines was already exporting about 1,000 tons of almaciga resin annually to the United States (West & Brown, 1920). Almaciga resin is often cited as among the important NTFPs, in the same league as rattan and bamboo. It has one of the most developed NTFP markets as it is internationally traded and regularly reported in the Philippine Forestry Statistics (PFS). From 1996 to 2000, the country exported more than 300,000 kg of almaciga resin per year, valued at USD 242,000 to USD 303,000 FOB. The export in the succeeding years fell and hit their lowest in 2012, with only 45,000 kg exported valued at USD 79,000 FOB. The export volume slowly increased; in 2016, 184,000 kg of resin were exported with a value of USD 152,000 FOB (PFS, 2016).

However, despite its long history of utilization and trade, the domestic production of the resin has dwindled over time, and with this, its contribution to the raw material supply for local industrial consumers and foreign exchange earnings. The regrettable situation of almaciga resin tappers, usually indigenous peoples and poor upland communities, has also been widely reported and is mainly attributed to low prices of almaciga resin at the tappers' level and the lack of financial and logistical means of tappers in resin harvesting and permit application (Evangelista *et al.*, 2021). Local traders and assemblers currently shoulder the costs of permit application (Razal *et al.*, 2013) needed to sell and transport the resin, which gives them the advantage of setting a low price at the tappers' level. The indigenous people now involved in almaciga resin collection may be the descendants of the natives referred to by West & Brown (1920) as the collectors of almaciga resin. Indeed, almaciga resin tapping is an important part of the culture of some indigenous people's groups in the Philippines, such as those in Palawan, Quezon, and Davao Oriental. And yet, after more than a hundred years of utilizing almaciga resin, the resin tappers remain poor.

Several factors have hindered the growth and development of the almaciga resin industry. One major reason is that almaciga resin has been traditionally seen as a minor forest product for a long time, and data on non-timber forest products were often not properly collected and organized in the past due to the concentration of efforts on timber production activities. This brought about weak decision support in crafting initiatives critical in harnessing the potential of almaciga resin as a high-value commodity.

This paper investigates the comparative advantage of resin tapping from the tappers' viewpoint and the industry's competitiveness in the international market. Specifically, it describes the industry's performance over the years and assesses whether almaciga resin production is still advantageous to the almaciga resin tappers and the country.

METHODOLOGY

Study sites

The study was conducted in two provinces – Palawan and Davao Oriental. There were two study sites in Palawan: Brooke's Point in Southern Palawan (**Figure 1a**) and San Vicente (**Figure 1b**) in Northern Palawan. The study site in Davao Oriental is the municipality of Governor Generoso (**Figure 1c**).

Data and data collection

The study used both primary and secondary data. Primary data were gathered through surveys with tappers and key informant interviews (KIIs) with middlemen, DENR personnel, local government unit representatives, and other informants. Secondary data were gathered from published literature, reports, and statistics on almaciga resin.

Theoretical framework

Economic theory dictates that in the absence of market distortions, the pattern of trade and specialization in the global economy is decided by comparative advantage. A comparative advantage assessment

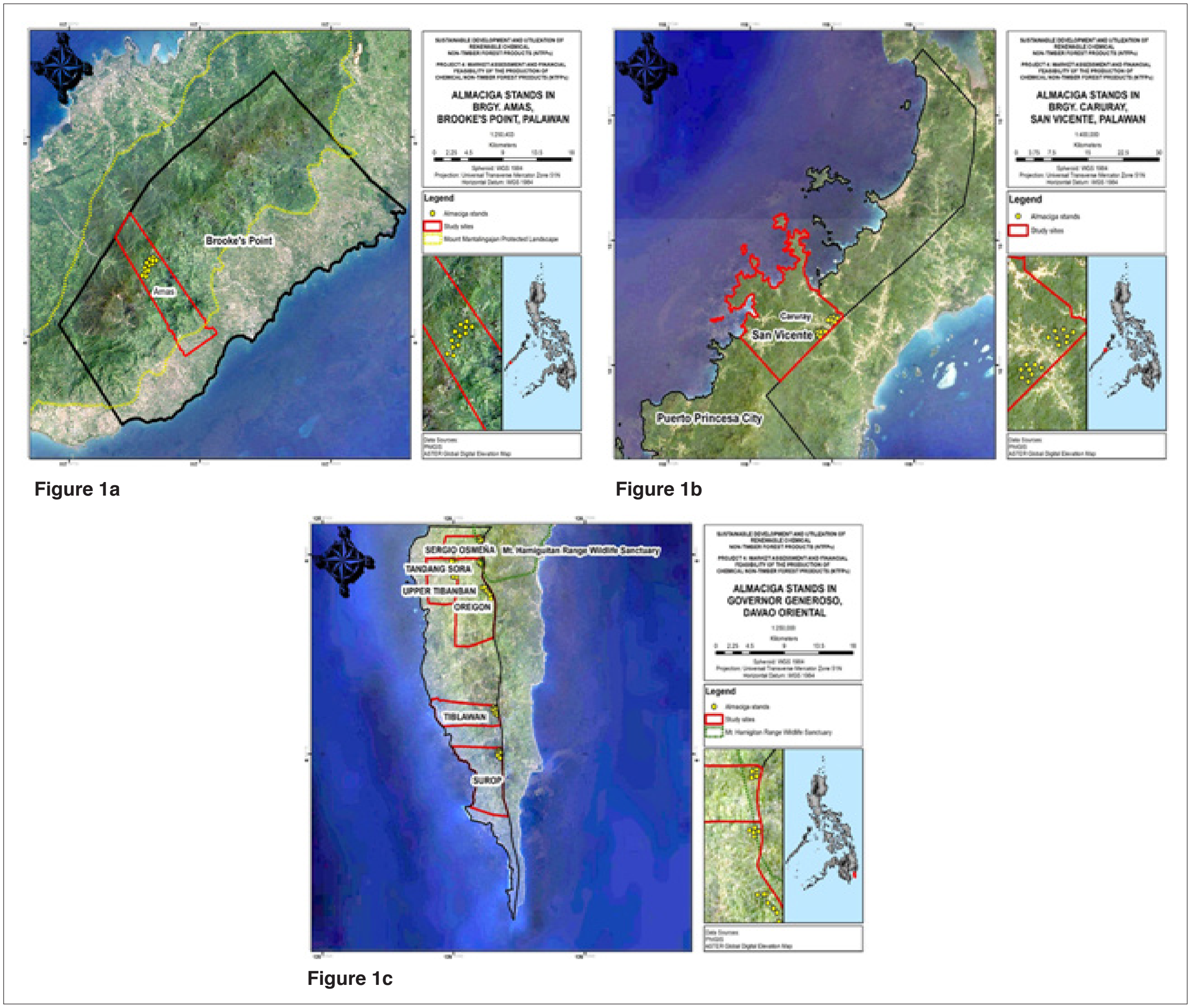

Figure 1. Study sites in Palawan and Davao Oriental, Philippines.

through the domestic resource cost (DRC) estimates demonstrates the competitiveness of a commodity in the international market. DRC is an alternative measure of competitiveness that is not affected by some introduced distortions in the market, such as the specialization of an economy in sectors where it is competitive and relying on international markets for sectors in which it is not competitive (Briones, 2016). In addition, DRC offers more evidence-based guidance for policy measures promoting the allocation of resources toward sectors with comparative advantage or addresses constraints facing sectors with potential comparative advantage.

Analytical procedure

The performance of the almaciga resin industry over the years was evaluated based on the volume of resin produced, its contribution to revenues generated for the government in forest charges, and the volume and value of exports and imports.

To assess the comparative advantage of almaciga resin production, this study followed the approach and method employed by Briones (2016) using the DRC and the closely related and much easier-to-interpret indicator, the DRCR. A DRC analysis posits that some domestic resources (*e.g.*, labor and land) are non-tradable, whereas the product is tradable. Consider the replacement of one unit of the imported product by its domestic counterpart. DRC is defined as follows, assuming production uses only primary factors, *i.e.*, total output equals value-added, and market prices equal opportunity cost:

$$DRC = \frac{CNTF}{BP} \qquad (1)$$

where, CNTF = cost of non-tradable factors (PHP), BP = border price, (USD). If the market exchange rate (ER) equals the opportunity cost of a dollar, then DRC < ER implies comparative advantage. It means expanding domestic production by a dollar worth of imports incurs domestic costs lower than the value of a dollar in domestic currency. The reverse holds true when DRC > ER, that is, saving a dollar worth of value added incurs a higher cost of domestic resources than the amount of domestic currency saved. The argument works even for goods that are exported. Consider expanding a unit of the commodity for sale to the foreign market. Here, DRC < ER implies that such a shift incurs lower domestic costs when compared to the foreign exchange earned. On the other hand, DRC > ER implies the reverse.

On the other hand, DRCR is defined as follows:

(2)

Hence, 0 < DRCR < 1 implies comparative advantage. The farther DRCR is from unity, the greater the comparative advantage. Likewise, DRCR > 1 implies comparative disadvantage, which means the farther DRCR is from unity, the greater the degree of comparative disadvantage (Minh *et al.* 2016). DRCR can be calculated using equation (3):

$$DRCR = \frac{DRC}{ER} \qquad (3)$$

where, CNIF is the cost of non-tradable inputs and factors in PHP, and BPP is the border price in PHP. The foregoing assumes that output equals value added. However, production requires intermediate goods. Suppose some of the intermediate goods are tradable; the above reasoning needs to be rephrased in terms of value-added as follows:

$$DRCR = \frac{CNIF}{BPP} \qquad (4)$$

The denominator is the border price less tradable intermediate inputs (TII) in PHP. Another important simplification is the assumption that market prices accurately estimate opportunity costs. However, market prices may diverge from opportunity costs due to distortions; prices corrected for these are called "shadow" or economic prices.

The study also applied the policy analysis matrix (PAM), as shown in **Table 1** (Monke & Pearson, 1989; Briones, 2016; Rashid & Matin, 2018), to organize the DRC analysis. The PAM is a computational framework augmented by Masters & Winter-Nelson (1995) for measuring input use efficiency in production and the degree of government interventions (Nelson & Panggabean, 1991). It provides a succinct summary of financial and economic payments to value-added and domestic costs. The analysis was applied to an annual allowable cut (AAC) of almaciga trees for tapping to impose constant returns to scale effectively, a universal premise implicit in all cost and return analyses based on the quantity of almaciga resin sold for a given AAC.

Table 1. The policy analysis framework.

	Revenue output	Cost		
		Tradable input	Domestic factor	Profit
Private/financial prices	A	B	C	D
Social/economic prices	E	F	G	H
Divergence (Effects of policy distortions)	I	J	K	L

Using information from **Table 1**, the following relationships hold:

$D = A - (B + C);$
$H = E - (F + G);$
$I = A - E;$
$J = B - F;$
$K = C - G;$
$L = D - H.$
$\text{Financial DRCR} = C/(A - B)$
$\text{Economic DRCR} = G/(E - F)$

Suppose DRCR > 0. Then using the definition of D and H, the following can be derived:

$\text{Financial DRCR} = C/(D - C) < 1 <> D < 0$
$\text{Economic DRCR} = G/(H + G) < 1 <> H < 0$

The shadow exchange rate is the market exchange rate raised by 5% (Bautista 2003). DRC estimation is limited to the level of primary production of almaciga resin. Information for DRC analysis is mostly obtained from cost and return results estimated from the survey and key-informant interview data. The analysis was done for the current and fair prices of almaciga resin tappers.

RESULTS AND DISCUSSION

The performance of the almaciga resin industry

Trade in almaciga resin could be traced to as early as the turn of the 20th century, in the early years of the American occupation of the Philippines. West & Brown (1920) presented records of the amounts and values of Manila copal exports from the Philippines from 1914 to 1918 (**Table 2**). From 1914 to 1916, the country exported more than 1,000 tons of almaciga resin per year, but the quantity was halved in 1917 and 1918. The value of exports ranged from a low of PHP 138,821 (in 1918) to a high of PHP 225,787 (in 1914). Pricewise, however, the price of almaciga resin increased by 72% from PHP 0.18 kg^{-1} in 1916 to PHP 0.32 kg^{-1} in 1918. During this period in the country's history, the Philippines peso was not yet tied to the US dollar. However, the 1918 parity between the Philippine silver peso and United States legal gold coins was pegged at USD 1 to PHP 2. Using this, the value per ton of almaciga resin exported ranged from USD 79.10 (1915) to USD 159.16 (1917).

Figure 2 shows the production of almaciga resin in the country from 1970 to 2019 and the corresponding forest charges paid by concessionaires and later by indigenous peoples' groups or organizations. For this period, the highest production of almaciga resin was recorded in 1982 at 1,407 tons, followed by 1994 (1,231 tons) and 1995 (1,059 tons). From 1996 until 2019, the reported production of almaciga resin was below 1,000 tons yr^{-1}, ranging from 204 tons in 2018 to 890 tons in 1996. **Figure 2** also shows the forest charges collected for almaciga resin from 1970 to 2019[2]. A sharp increase could be observed in 1992, corresponding to the year when RA 7161 was implemented that set the forest charge for almaciga resin to PHP 1 (USD 0.02) kg^{-1} in 1991 to PHP 1.50 (USD 0.03) kg^{-1} in 2000, which remains the forest charge rate being used up to the present (DAO, 2000). Except for 2015, when the forest charge dipped, the volume of almaciga resin and the forest charges collected from 1992 followed almost the same trend.

Figure 3 shows the regions that produced almaciga resin for the same period. From 1970 to 1975, the sources of almaciga resin were identified as Luzon, Mindanao, Visayas, and Palawan, the latter identified separately from Luzon and was the top producer. From 1975 to 2019, the regional sources of almaciga resin were Region 1 (1981), Region 2 (1978, 1982–1985, 1987, 1999, and 2008–2009), Region 3 (1977–1978, 1984–1985, and 1988–1991), Region 4A (1977–1978, 1995, and 1999), Region 4B (1978 and 1981–2019), Region 5 (1982), Region 6 (years), Region 7 (1978 and 1990–1991), Region 8 (1977, 1982–1983, 1985–2001, 2004, 2007–2012, and 2014–2015), and Region 10 (1981–1983, 1989–1994, 1996–1997, 1999–2001, 2004, 2007–2012, and 2014–2015). No more resin production was reported in Region 3 (presumably Aurora) by 1992, Region 4A (presumably Quezon) by 2000, Region 2 by 2010, and Region 8 by 2016. Region 4B, presumably the province of Palawan, was the consistent top producer of almaciga resin, exceeded by Region 8 only in 2004. By 2016, only the province of Palawan was reported to have produced almaciga resin. No almaciga resin was reported from Mindanao, but the municipality of Governor Generoso in Davao Oriental began producing almaciga resin in

2 The forest charges are expressed in Philippine pesos as the exchange rate to the US$ varied over the period

Table 2. Amount and value of Manila copal exports from the Philippines, 1914 to 1918 *(Source: West & Brown, 1920)*.

Year	Amount (kg)	Value (PHP)	Unit export Value (PHP kg-1)[a]	Amount (ton)[a]	Unit Export value (PHP ton-1)[a]	Unit Export value (USD ton-1)[ab]
1914	1,112,787	225,078	0.20	1,112.79	202.27	101.13
1915	1,304,975	206,446	0.16	1,304.98	158.20	79.10
1916	1,143,938	211,593	0.18	1,143.94	184.97	92.48
1917	593,560	188,940	0.32	593.56	318.32	159.16
1918	507,116	138,821	0.27	507.12	273.75	136.87

[a]*Derived values; Exchange rate used in the paper to convert all monetary values into US dollar equivalent: 1 USD = PHP 50*
[b]*1918 parity between the Philippine silver peso and legal gold coins of the United States of USD 1: PHP 2 by virtue of Act No 2776 (Nagano 2010)*

2012, exclusively selling the resin to a company in Cebu. Since 2012, Governor Generoso has been shipping six to eight tons of almaciga resin to Cebu every month, or about 72 to 96 tons yr^{-1}.

No reports or literature were found about what happened to the almaciga resin production in the regions that were previously reported to have produced almaciga resin. Possible reasons include the cessation of resin tapping activities due to over-tapping or destructive tapping; resin tapping is no longer viable due to low resin yields or depletion of accessible almaciga stands, or non-reporting of almaciga resin production data as was observed in Governor Generoso, where resin production was not reported in the 2021 Philippine Forestry Statistics.

Figure 4 shows the volumes of almaciga resin exported from 1970 to 2019 and the corresponding values (FOB in thousand dollars). The highest export volumes were recorded in 1973 (1,112 tons) and 1978 (1,049 tons), with the export volumes in other years being less than 1,000 tons. A generally decreasing trend can be observed, with the lowest export volume reported in 2014 (49 tons). Except for 1970 to 1977, when the export volume trend was decreasing while that of the export value was increasing due to increasing price per ton of resin, the export value trend from 1978 to 2019 generally was the same direction as the export volume.

It is interesting to note that the resin exports of the country from 1914 to 1916 (**Table 2**) were about the same as the exports in 1973 and 1978, while the exports from 1914 to 1918 were higher than the country's exports beginning 1988 (407 tons) until 2019 (72 tons). **Figure 5** shows the domestic production and export of almaciga resin from 1970 to 2019. Except for the years when the export exceeded production (*i.e.*, years 1971, 1973, 1975 to 1981, 1983 to 1987, 1997 to 1999, and 2007, which may imply erroneous reporting of domestic production and export data), the difference between production and export represents domestic use or consumption, indicating that for most years, a higher proportion of the almaciga resin produced was used by local industries. This is consistent with the findings of (Razal *et al.,* 2013) that the volume of domestic consumption was about 80% of the total volume of almaciga resin produced in the country.

From 1970 to 2019, the Philippine Forestry Statistics (PFS) reported importation of almaciga resin only for two years: in 1993 with a volume of 5 tons and value of USD 10,992 from France and in 2012 with a volume of 5 tons and value of USD 60,743 from China, or prices of USD 2,198.40 and USD 12,148.60, respectively. Imports of almaciga resin were reported separately from the other products from 2001 to 2003 but appeared to have been incorporated in the general group from 2004 onwards. Percentage-wise, the contribution of almaciga resin imports from 2001 to 2003 was less than 0.5%.

Almaciga resin has always been cited as a major non-timber forest product, usually after rattan and bamboo, in terms of production value. The PFS provides the quantity produced of different non-timber forest products in the country, namely almaciga resin, anahaw leaves, and poles, bamboo poles, buri midribs, hingiw, nipa leaves and shingles, diliman and other vines, salago fiber, and split and unsplit rattan. However, the PFS does not indicate the domestic value of these NTFPs. Instead, only the values of exports of almaciga resin, elemi gum, bamboo, rattan poles, and salago fiber are reported. Figure 6 shows the quantities and values of exports of these NTFPs from 1998 to 2019. Among other things, it can be seen that elemi gum and salago fiber have overtaken the export value of almaciga resin.

Resin production in the study sites

The people's organizations (POs) involved in the study were the Lumad Almaciga Tappers Association of Governor Generoso (LATAGG) in Governor Generoso, Davao Oriental, the Caruray Agricultural Marketing Association (CAMA) in San Vicente, Palawan, and the Samahan ng mga Palaw'ans sa Amas Brooke's Point (SPABP), Brooke's Point.

A 2012 inventory in Governor Generoso revealed that there were 106,532 almaciga trees, of which 71,338 were considered tappable, *i.e*., with a diameter breast height (DBH) of 40 cm and above. The tappable trees were projected to have a total yield of 22,148 kg of resin yr^{-1}, but the output based on the shipment to the lone buyer in Cebu (about 8,000 kg mo^{-1}) was estimated to be 96,000 kg yr^{-1}. The current private price of resin is PHP 20 (USD 0.40) kg^{-1}, and the corresponding economic price at the current situation is about PHP 35.69 (USD 0.72) kg^{-1}.

On the other hand, the PO in San Vicente, Northern Palawan, has an annual allowable cut of 120,000 kg yr^{-1}, but the actual output was estimated at 80,400 kg yr^{-1}. The current market and economic prices of resin in the area are PHP 26 (USD 0.34) kg^{-1} and PHP 31.56 (USD 0.63) kg^{-1}, respectively. For the PO in Brooke's Point, Southern Palawan, the annual allowable cut is

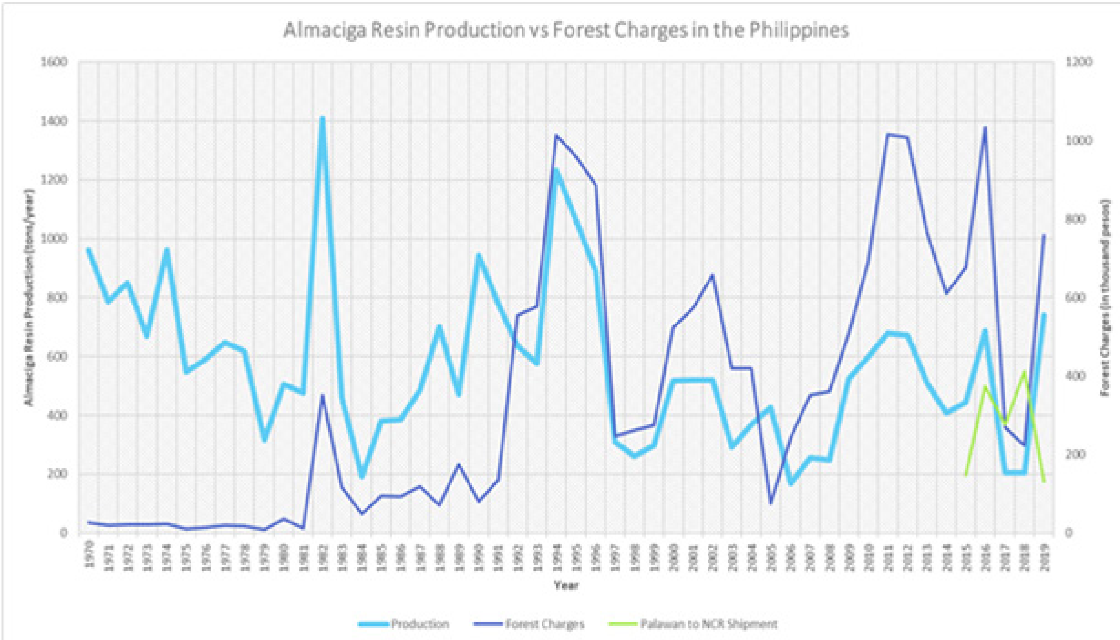

Figure 2. Almaciga resin production and forest charges in the Philippines, 1970–2019 and almaciga resin shipment from Palawan to NCR, 2015 – September 2019 *(Source: FMB-Philippine Forestry Statistics, various years; DENR NCR)*

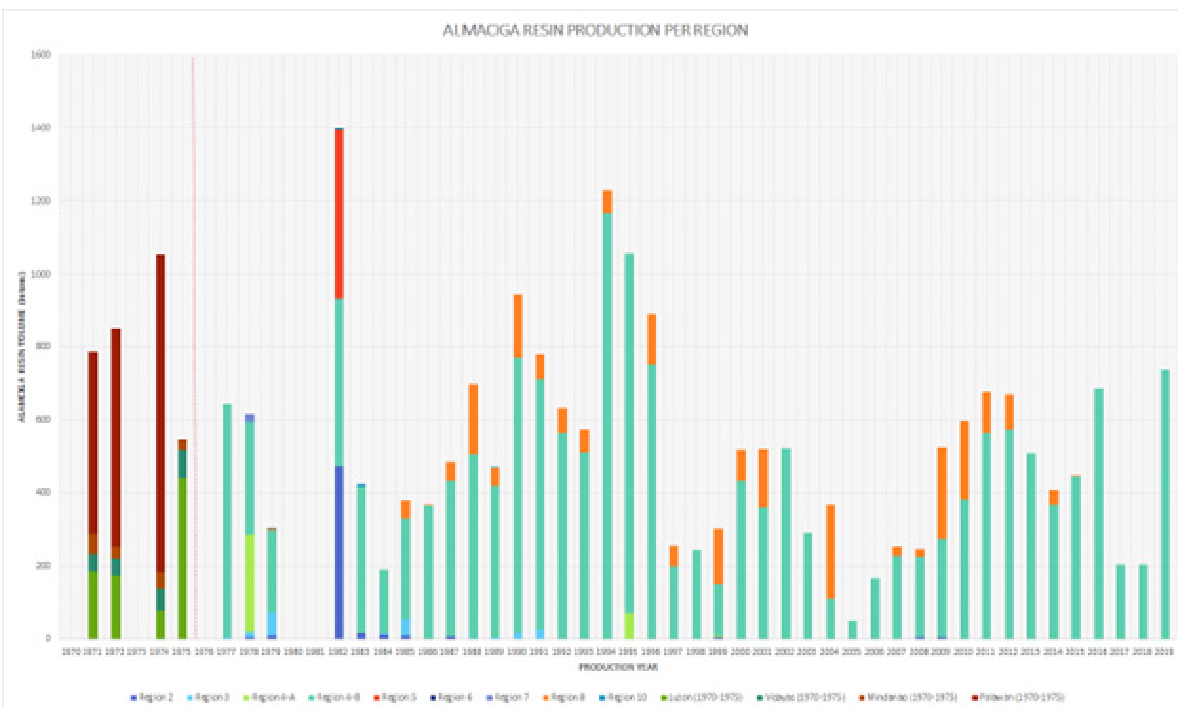

Figure 3. Sources of almaciga resin in the Philippines by region, 1970–2019 *(Source: FMB, various years).*

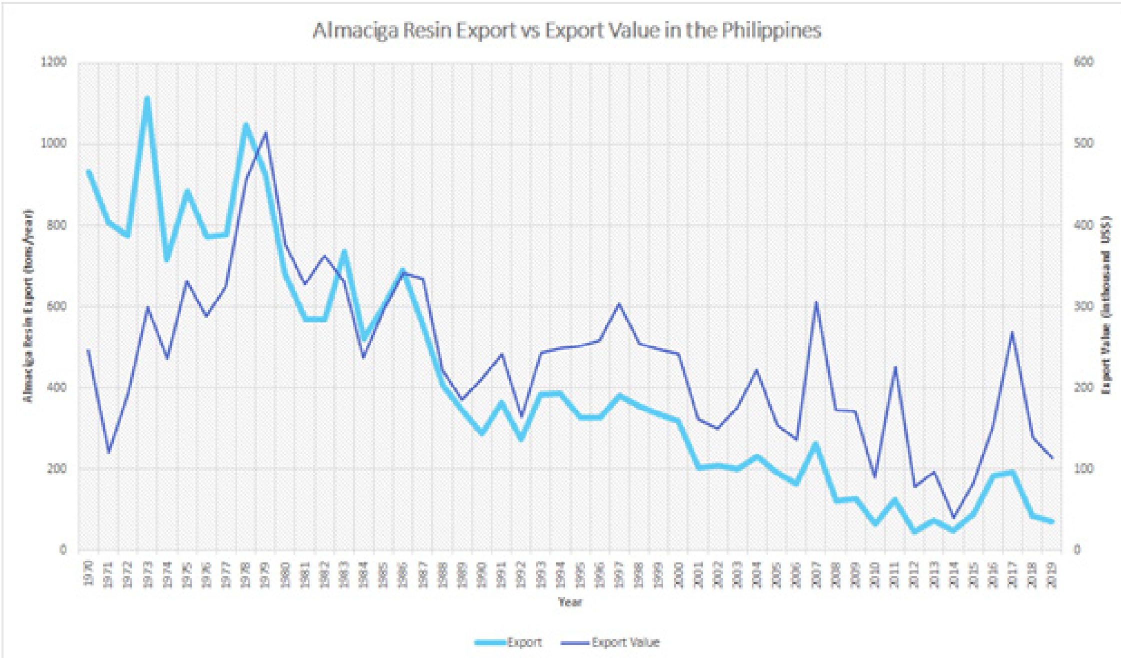

Figure 4. Almaciga resin export volume and value from the Philippines, 1970–2019 *(Source: FMB-Philippine Forestry Statistics, various years).*

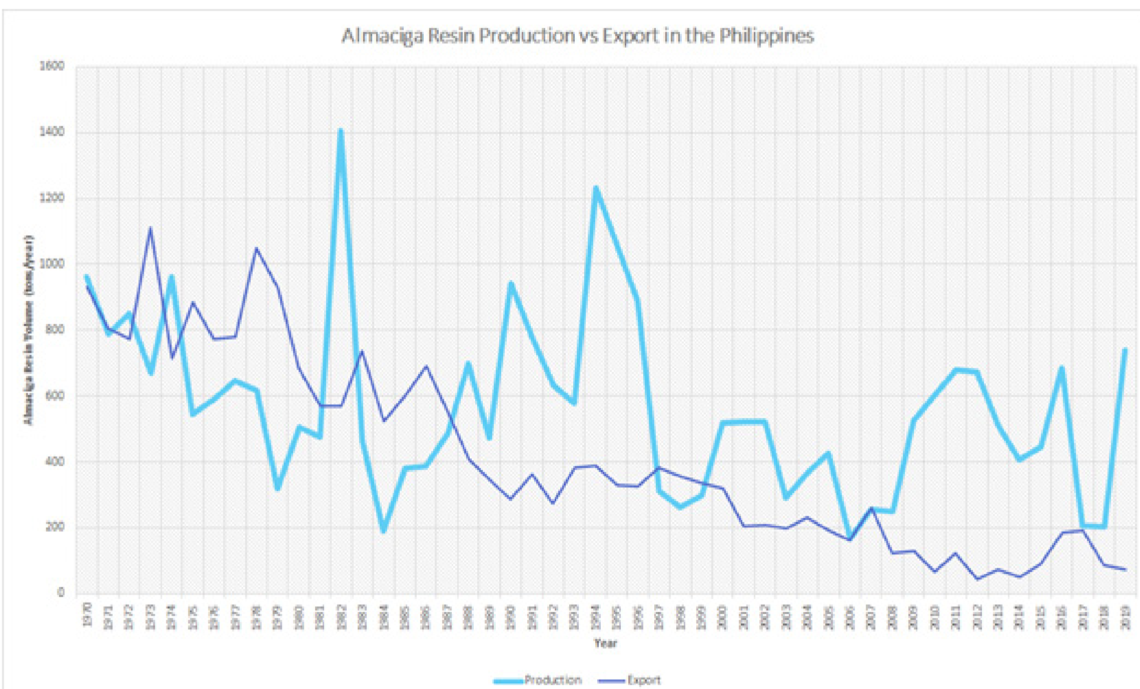

Figure 5. Volume of production and export of almaciga resin, Philippines, 1970–2019 *(Source: FMB-Philippine Forestry Statistics, various years).*

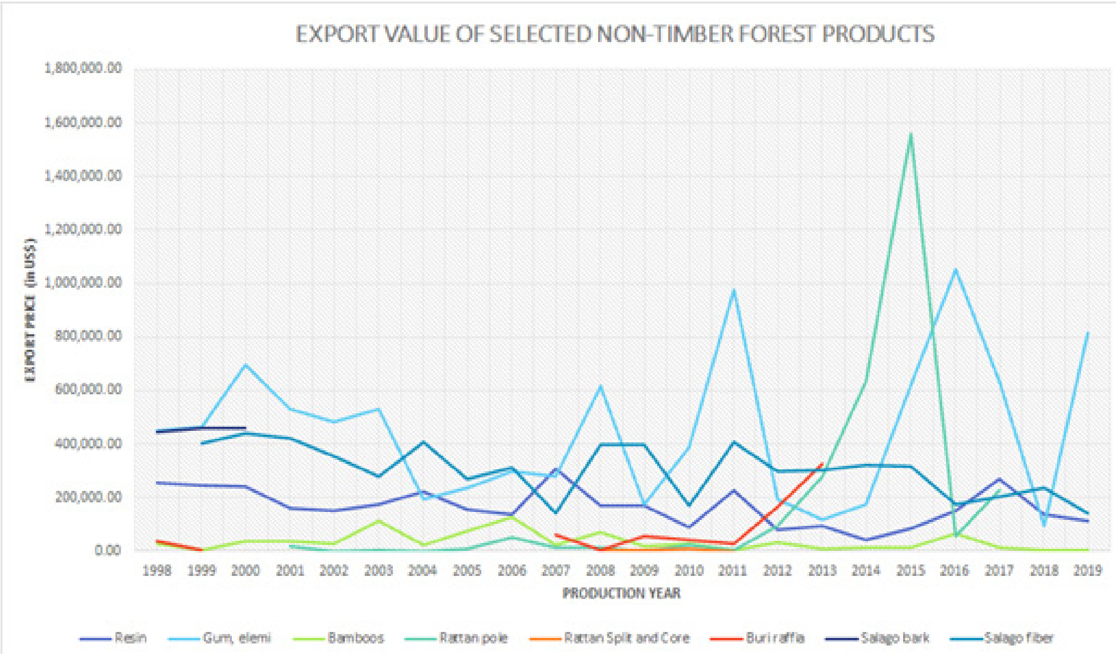

Figure 6. Quantities and values of selected NTFP exports, 1998–2019 *(Source: FMB-Philippine Forestry Statistics, various years).*

30,000 kg yr^{-1}, while the current market price of resin in the area is at PHP 30 (USD 0.60) kg^{-1}, and its economic price is about PHP 31.99 (USD 0.64) kg^{-1}.

The policy analysis matrix for almaciga resin

The policy analysis matrix estimates for almaciga resin at the current price for three sites, which were discussed earlier, are presented in **Table 3**. Almaciga resin production among tappers is highly profitable from financial and economic perspectives. This is due to relatively very low inputs resource costs which are all non-tradable such as labor and materials. Economic prices for non-tradable inputs were based on the rule of thumb of 20% lower than their private prices.

Based on shadow prices, the DRCR values for all sites (0.061 for Governor Generoso, 0.057 for Northern Palawan, and 0.065 for Southern Palawan) are less than unity. A low DRC ratio implies a high-profit margin and supports sustainability (Cai *et al.*, 2009). This means that almaciga resin production for all sites at current prices has a comparative advantage, and therefore it is competitive in the international market based on economic prices. For example, a DRCR of 0.061 in Governor Generoso implies PHP 0.061 (USD 0.00122) worth of domestic inputs were spent to save PHP 1.00 (USD 0.02) worth of foreign exchange. In evaluating the comparative advantage of Dak Lak coffee in Vietnam, Minh *et al.* (2016) found that Dak Lak province's comparative advantage in coffee production for export is sensitive to fluctuations in coffee export prices. Even with the world prices being higher under the shadow exchange rate (SER), domestic almaciga resin still exhibits a comparative advantage, as seen in the DRC/SER ratio of 0.058. A similar trend was found in Northern and Southern Palawan, with DRCR and DRC/SER ratios less than unity. Rashid & Matin (2018) also applied the policy analysis matrix to examine the relative efficiency of producing pulse crops in Bangladesh and its comparative advantage in international trade. The DRC results were less than unity, Bangladesh's comparative advantage in producing selected pulse crops relative to other countries. In another study by Assagaf *et al.* (2021), the computed DRCR values were also less than one for nutmeg spice farming in Ternate City in North Moluccas, indicating that nutmeg farming has a comparative advantage as well. Okoye *et al.* (2020) obtained similar results using a policy analysis matrix in assessing the market competitiveness among sweet potato farmers in Nigeria.

PAM estimates at a fair price are presented in **Table 4**. Fair price from a private viewpoint was taken from cost and return results, comprised of domestic resource cost, the opportunity cost of time, and 20% markup. Due to limited data on shadow price estimation of bringing

Table 3. Policy analysis matrix for almaciga resin at current price by sites (PHP yr^{-1} - total output).

Item	Revenue	Resource cost		Profit	DRCR	DRC SER
		Tradable	Non-tradable			
Governor Generoso: Total output = 96,000 kg						
Financial	1,920,000 ($38,400)	0	259,200 ($5,184)	1,660,800 ($33,216)	0.135	0.129
Economic	3,426,240 ($68,525)	0	207,360 ($4,147)	3,218,880 ($64,378)	0.061	0.058
Divergence	–1,506,240 ($ –30,125)	0	51,840 ($1,037)	–1,558,080 ($–31,162)		
Northern Palawan: Total output = 80,400 kg						
Financial	2,090,400 ($41,808)	0	180,900 ($3,618)	1,909,500 ($38,190)	0.087	0.082
Economic	2,537,424 ($50,748)	0	144,720 ($2,894)	2,392,704 ($47,854)	0.057	0.054
Divergence	–447,024 ($–8,940)	0	36,180 ($724)	–483,204 ($–9,664)		
Southern Palawan: Total output = 30,000 kg of *tipak*						
Financial	900,000 ($18,000)	0	78,300 ($1,566)	821,700 ($16,434)	0.087	0.083
Economic	959,700 ($19,194)	0	62,640 ($1,253)	897,060 ($17,941)	0.065	0.062
Divergence	–59,700 ($–1,194)	0	15,660 ($313)	–75,360 ($–1,507)		

DRC = domestic resource cost, DRCR = domestic resource cost ratio; Figures in parenthesis are in USD, USD 1 = PHP50 (Source: Authors' calculations)

Table 4. Policy analysis matrix for almaciga resin at a fair price by sites (PHP yr^{-1} - total output).

Item	Revenue	Resource cost		Profit	DRCR	DRC SER
		Tradable	Non-tradable			
Governor Generoso: Total output = 96,000 kg						
Financial	3,115,200 ($62,304)	0	2,595,840 ($51,917)	519,360 ($10,387)	0.833	0.794
Economic	3,738,240 ($74,765)	0	2,076,672 ($41,533)	1,661,568 ($33,231)	0.556	0.529
Divergence	–623,040 ($ –2,461)	0	519,168 ($10,383)	–1,142,208 ($ –22,844)		
Northern Palawan: Total output = 80,400 kg						
Financial	2,508,480 ($50,170)	0	2,114,520 ($42,290)	393,960 ($7,879)	0.843	0.803
Economic	3,010,176 ($60,204)	0	1,691,616 ($33,832)	1,318,560 ($26,371)	0.562	0.535
Divergence	–501,696 ($ –10,034)	0	422,904 ($8,458)	–924,600 ($ –18,492)		
Southern Palawan: Total output = 30,000 kg of *tipak*						
Financial	1,391,760 ($27,835)	0	799,800 ($15,996)	591,960 ($11,839)	0.575	0.547
Economic	1,670,112 ($33,402)	0	639,840($12,797)	1,030,272 ($20,605)	0.383	0.365
Divergence	–278,352 ($ –5,567)	0	15,960 ($3,199)	–438,312 ($–8,766)		

DRC = domestic resource cost, DRCR = domestic resource cost ratio; Figures in parenthesis are in USD, USD 1 = PHP50 (Source: Authors' calculations)

the parity price or border price to the farm gate level, a rule of thumb was used where economic prices are 20% higher than private prices. The estimated market or private fair prices used in the analysis are as follows: PHP 32.45 (USD 0.649) kg^{-1} for Governor Generoso, PHP 31.20 (USD 0.624) kg^{-1} for North Palawan, and PHP 46.39 (USD 0.928) kg^{-1} for Southern Palawan area. On the other hand, the corresponding economic fair prices of almaciga resin per kg are PHP 38.94 (USD 0.779) for Governor Generoso, PHP 37.44 (USD 0.749) for Northern Palawan, and PHP 55.67 (USD 1.113) for Southern Palawan.

The PAM results show that almaciga resin production of tappers using fair price is still highly profitable from private and social viewpoints. While the fair price was higher than the current price, the cost per unit of output has correspondingly increased to account for the opportunity cost of time of tappers. With the increased fair private and economic prices, DRCR estimates are higher than the values obtained at the current price situation for all sites. Nevertheless, all DRCR estimates are still less than unity (0.556 for General Generoso, 0.562 for Northern Palawan, and 0.383 for Southern Palawan). These imply that imposing a fair price policy at the farm gate level will still make almaciga resin production among tappers in all study sites competitive in the international market.

Adjusting further the world prices to be higher under the shadow exchange rate (SER), domestic almaciga resin still exhibits a comparative advantage, as seen in the DRC/SER ratio of less than one for all sites. It is noted, however, that a country's comparative advantage depends on factors that are inherent to the country, such as its geographic position, climate, or natural resources that cannot be altered, as well as other factors like farming technology and human resources that can be modified or developed (Cai *et al.*, 2009). Furthermore, efforts to improve the quality and quantity of almaciga resin through proper resin harvesting techniques that reduce waste and yield export-quality almaciga resins should be pursued (Ella & Samiano, 2015).

CONCLUSION AND RECOMMENDATIONS

The performance of the almaciga resin industry has been declining since the 1970s in terms of production and exports, resulting in decreasing contributions to the country's gross domestic product. Almaciga resin production at the current price level was found to be highly profitable from private and social perspectives. Due to the very low market price of almaciga resin, private profitability was greater than social profitability. The relatively low cost of almaciga resin production resulted in a competitive almaciga resin industry in the international market with a DRC ratio of less than 1 (DRC < 1) for all study sites. It is therefore, more advantageous for the domestic demand for almaciga resin to be met with locally produced resin, and the resin in excess of the local demand that meets the export volume requirement can be exported. This implies that government support for the almaciga resin tappers is justified.

The PAM results show that almaciga resin production of tappers using a fair price is still highly profitable from private and social viewpoints. While the fair price was higher than the current price, the cost per unit of output has correspondingly increased to account for the opportunity cost of time of tappers. With the increased fair, private price and economic price, DRCR estimates are higher compared with the values obtained at the current price situation for all sites. Nevertheless, all DRCR estimates are less than unity for the three study sites. Imposing a fair price policy at the farm gate level will still make almaciga resin production among tappers competitive in the international market. Even further adjusting the world prices to be higher under the shadow exchange rate (SER), domestic almaciga resin still exhibits a comparative advantage, as seen in the DRC/SER ratio of less than one for all sites. Based on the above findings, the study recommends that the almaciga resin industry take advantage of its competitiveness in the international market by adding the opportunity cost of tappers to the resin price and, at the same time, sustain the efforts of improving the quality and quantity of almaciga resin by adopting proper resin harvesting techniques that reduce wastes and yield export-quality almaciga resins.

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