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Inclusive Growth through the Coco Chemical Industry: From Coconuts to High-Value Products

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INCLUSIVE GROWTH THROUGH THE COCO CHEMICAL INDUSTRY: FROM COCONUTS TO HIGH-VALUE PRODUCTS

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Abstract

The Philippines can only reduce poverty by addressing the root of poverty and the coconut sector is among the poorest. At the same time, the coconut sector offers the greatest potential to attain the goal of inclusive growth by providing the jobs and spurring agricultural and industrial development that are sustainable.

To achieve this, the coconut industry should diversify horizontally by effective intercropping and integrate vertically by improving upstream raw material production and downstream high-value products. At the center of these efforts of vertical integration and horizontal diversification is the coconut farmer. Measures to redress the social, economic, and political injustices, which the coconut farmers have suffered, should be prioritized.

The copra-based industry should be phased out and replaced with technology that can effect the full value recovery of the coconut. The shift away from copra towards integrated processing will enable full processing of the coconut and higher quality of product. However, this will require larger investments in processing centers, which should be strategically located for cheaper transport of coconuts from the farm, as well as transport to downstream factories. The costs of transport and logistics have to be considered. Value-adding processes for fatty acids and methyl esters should be promoted to raise earnings from the coconut.

The strategy for the Philippine coconut industry must be comprehensive and must consider measures at various levels: the coconut farmer, the local level, the oil mills and processors, the cocochemical industry, government

intervention and support, and S&T initiatives. A number of coconut federations and industry groups have proposed that the Coco Levy Funds be used for the benefit of the coconut farmers and the revitalization of the coconut sector.

Keywords: Philippine coconut industry, poverty, copra, inclusive growth

Introduction

The *Philippine Development Plan 2011-2016* boldly sets for the administration of President Benigno S. Aquino III the objective of attaining "inclusive growth" which was defined by the Philippine Development Plan as "growth that is sustained, that massively creates jobs, and reduces poverty."

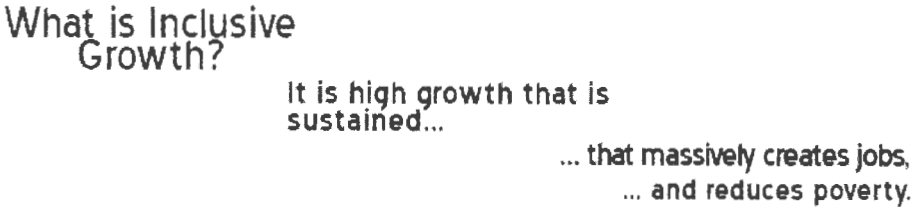


Figure 1. "Inclusive Growth" as defined in the Philippine Development Plan 2011-2016.

The National Academy of Science and Technology shares the same aspiration as Pres. Aquino, and thus embarked on a program to construct a Roadmap for Inclusive Growth. The focus of the NAST effort was to show how the Philippines can harness science and technology in reviving the manufacturing sector.

The Philippines can only reduce poverty by addressing the root of poverty, and among the poorest sectors is the coconut sector. The coconut sector, however, has the potential to provide sustained agricultural and industrial growth, provide wide employment opportunities in a diverse range of areas, and significantly reduce poverty.

The impressive growth that the Philippines has been experiencing cannot be sustained unless we attain inclusive growth, defeat poverty, and remain competitive. The principal thesis of this paper is two-fold:

- First, the problems of the coconut sector must be addressed if the Philippines is to attain inclusive growth, and
- Second, this sector, properly developed, can provide sustainable agricultural and industrial growth to attain inclusive growth.

A comprehensive roadmap requires a strategy that combines social, economic, and political reform, together with scientific and technological innovation. Institutionally, this effort needs the leadership and vision from the President in order to coordinate all the agencies of government, harness the active cooperation of the private sector, and most importantly, win the support of the most affected sector – the coconut farmers.

Inclusive Growth through an Agro-Industrial Strategy

"Inclusive growth" is the development paradigm that considers "both the pace and pattern of growth, which are considered interlinked, and therefore in need to be addressed together" (Ianchovichina and Lundstrom 2009). The paradox of Philippine economic growth of the past decade has been one of the relatively high growth rates amidst stubborn poverty. Indeed, the Philippine Development Plan 2011-2016 acknowledged that inclusive growth "is an ideal which the country has perennially fallen short of, and this failure has had the most far-reaching consequences, from mass misery and marginalization, to an overseas exodus of skill and talent, to political disaffection and alienation, leading finally to threats to the constitution of the state itself."

The Philippine Development Plan 2011-2016 enumerated the following measures that the Philippine government will prioritize in pursuit of inclusive growth:

- Massive investment in infrastructure
- Transparent responsive governance
- Human development together with employment generation

The National Anti-Poverty Program (2010-2016), which was prepared by the National Anti-Poverty Commission (NAPC), complements the Philippine Development Plan, stating that:

> "Poverty reduction can be accelerated in two ways, through more rapid economic growth and/or by improving the impact of economic growth on the poor. The latter can be done by undertaking the following:
>
> a. Creating productive employment opportunities. In particular, there will be an emphasis on the development of enterprises that provide the highest value-added to agricultural outputs.
> b. Increasing agricultural productivity.
> c. Facilitating economic diversification, especially in rural areas" (NAPC 2010b).

The National Anti-Poverty Program identified two important objectives: first, the development of enterprises that provide the highest value-added to agricultural outputs; and second, the increase in agricultural productivity.

In both programs of the Philippine Development Plan and NAPC, science and technology can play an important role in the pursuit of inclusive growth and sustainable development but neither agency recognized this.

Among the agricultural sectors, the coconut sector has the highest levels of poverty incidence and the lowest allocation of government support. In terms of size, the number of coconut farmers is comparable to the numbers of rice farmers and fishers (NAPC 2010a) (Figure 2). However, the coconut farmer is the most neglected.

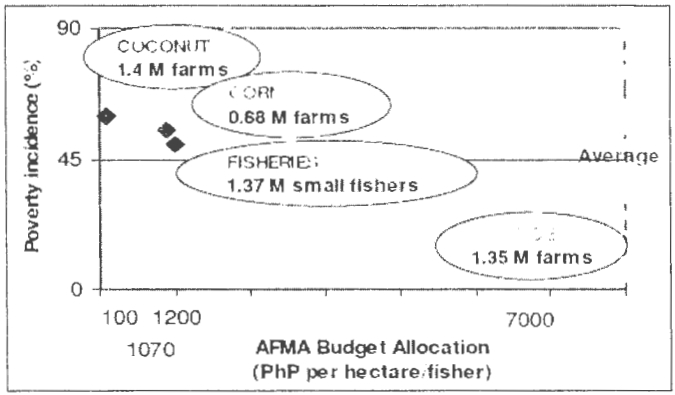


Figure 2. Poverty incidence and allocation of agricultural modern assistance (NAPC 2010a).

The Role of Manufacturing in Inclusive Growth

Norio Usui, senior country economist, Philippines Country Office, Asian Development Bank, in his book: *Taking the right road to inclusive growth: Industrial upgrading and diversification in the Philippines*, advanced the treatise that:

> "The main reason behind the Philippines' lagging growth performance and development outcomes in the regional context lies in a sluggish transformation of the economy – in particular stagnant industrialization – in the past decades. The Philippine economy's chronic problems of high unemployment, slow poverty reduction, and low investment are reflections of the sluggish industrialization... To achieve inclusive growth, the Philippines needs to develop a stronger industrial sector to create productive job opportunities for the growing labor force." (Usui 2012)

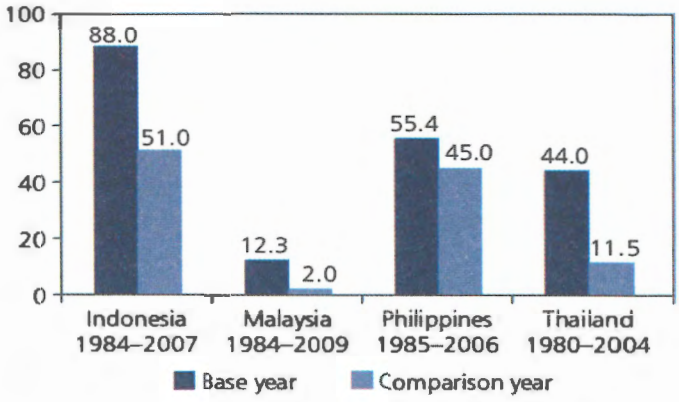
Unfortunately, since the 1980s, the Philippines has taken the path of de-emphasizing the Industry sector in favor of increasing the Services sector. This is in marked contrast to the path taken by our more progressive ASEAN neighbors – Indonesia, Malaysia, and Thailand – which chose to grow their Industry sector more vigorously (Table 1).

A comparison of the rates of poverty reduction shows that our ASEAN neighbors performed better in choosing industrialization as their strategy. Indonesia, Malaysia and Thailand decreased their respective poverty incidences by 42%, 84%, and 56%, respectively, compared with the Philippines, which showed poverty reduction of only 19% (Figure 3).

The Philippines today is faced with the twin challenges of attaining inclusive growth and being globally competitive. The first challenge is rooted mainly in agriculture, whereas the second challenge requires a competitive industry and science and technology. The Coconut sector is the most strategic sector that can address both challenges of attaining inclusive growth and global industrial competitiveness. Science and technology, if properly focused and supported, can fuel the drive for *both* inclusive growth and global competitiveness.

Table 1. Comparison of structural changes in Indonesia, Malaysia, the Philippines, and Thailand, 1980–2009 (Usui 2012). Output Structure (% of GDP)

Sector	Indonesia			Malaysia		
	1980	2009	Change	1980	2009	Change
Agriculture	24.0	15.9	(8.1)	22.6	9.5	(13.1)
Industry	41.7	49.6	7.9	41.0	44.3	3.3
Manufacturing	13.0	27.4	14.4	21.6	25.5	3.9
Services	34.3	34.5	0.2	36.3	46.2	9.9
Total	100.0	100.0		100.0	100.0	
Sector	**Philippines**			**Thailand**		
	1980	**2009**	**Change**	**1980**	**2009**	**Change**
Agriculture	25.1	13.1	(12.0)	23.2	11.5	(11.7)
Industry	38.8	31.7	(7.1)	28.7	43.3	14.6
Manufacturing	25.7	21.3	(4.4)	21.5	34.2	12.7
Services	36.1	55.2	19.1	48.1	45.2	(2.9)
Total	100.0	100.0		100.0	100.0	



	Indonesia	Malaysia	Philippines	Thailand
Absolute change	-37.0%	-10.3%	-10.4%	-47.7%
% Change	-42%	-84%	-19%	-56%

Figure 3. Comparison of poverty reduction in Indonesia, Malaysia, the Philippines, and Thailand, 1980s-2000s: % of total population based on headcount ratio at $2 a day PPP (Usui 2012). The table below gives the absolute change in poverty and the % change in poverty.

The Coconut Sector

Coconut is the second most dominant agricultural sector in the Philippines (Table 2) (Carpio 2013; Romero Jr. 2013). The coconut agricultural sector ranks second to rice in terms of hectares planted. It is present in the majority of provinces in the country. There are about 3 million coconut farmers who were organized into associations, cooperatives, and federations during the Marcos era. An estimated 25 million people are involved in coconut-related enterprises. However, the majority (91%) of coconut farms are small landholdings of 5 hectares or less (Figure 4). Using the data in Table 2, and assuming the millgate price of copra ranges from P12/kg to P20/kg, the income of a typical small coconut farmer owning 5 hectares would range from about P50,000 to 80,000/year. This places the small coconut farmer below the poverty level if his only source of income is from the sale of his copra.

Table 2. Data on the coconut agricultural sector. (Romero Jr. 2013; Carpio 2013)

Area Planted to Coconut (2011):	3.562 M hectares* (26% of total agricultural land)
Number of Provinces Covered:	68 out of 79 (86%)
Number of Municipalities Covered:	1, 195 out of 1,491 (80%)
Number of coconut farmers:	3M (estimate)
Number of coconut farmers' associations:	11,000
Number of coconut farmers' cooperatives:	953
Number of coconut farmers' federations:	9
Number in coconut-related enterprises:	25M (estimate)
Number of Coconut Trees:	340 M (estimate)
Number of Senile Coconut Trees:	44 M (estimate) (~13% or total)
Nut Production (average):	43 nuts/tree/year; 15.2 B nuts/year

* In comparison, rice has a total harvested area of 4.5 M ha. (Ref: Rice in the Philippines, International Rice Research Institute) (http://irri.org/index.php?option=com_k2&view=item&id=10718:rice-in-the-philippines&lang=en)

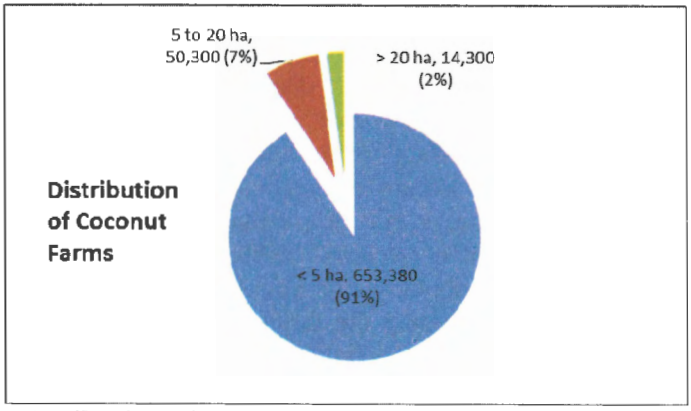


Figure 4. Distribution of coconut farms. (Romero Jr. 2013)

Table 3 summarizes the coconut exports in terms of both amount and value from 2005 to 2010. Copra meal accounted for about 25% of the total export by volume but only 4.5% of the earnings, whereas the other products had higher earnings per unit volume. Copra meal is a relatively low value product.

Table 3. Coconut exports from 2005-2010: amount exported (in '000 MT) and earnings (in Million US$ FOB). (Agustin 2011)

Type of Product	Coconut Oil	Desiccated Coconut	Copra Meal	Oleo-chemicals	Total
Export volume (In '000 MT)	6,126	761	2,842	468*	11,368*
	53.9%	6.7%	25.0%	4.1%	
Earnings (In Million US$ FOB)	4,842	962	284	273	6,361
	76.1%	15.1%	4.5%	4.3%	

* Exports of coconut products are expressed in terms of copra or copra equivalent. Exports include coconut oil, desiccated coconut, copra meal and oleochemicals expressed as copra.

The export of coconut products accounts for about 65–70% of the total coconut production. The volume of exports showed a gradual, though erratic, decline in exports of about 4.7% during the past 10 years. However, domestic consumption of coconut showed a steady increase of 4.6% during the same period. (Figure 5) Meanwhile, the share of domestic consumption has grown in the last 5 years, averaging about 34% of the total as compared with 15% in the 1970s. This is largely due to biodiesel utilization and increased domestic "buko" consumption (Carpio 2013).

The export of copra has been very low and very erratic. In such situations, it is the copra farmer who is most vulnerable. For example, there was no copra export from 2006 to 2008 while from 2009-2011, copra turned in USD59,795, USD239,027, and USD257,720. The erratic nature of copra prices keeps the coconut farmer at the mercy of the trader. A shift towards the full processing of the coconut into higher-value products can stabilize and increase the price of coconut at the farm level to the benefit of the coconut farmer.

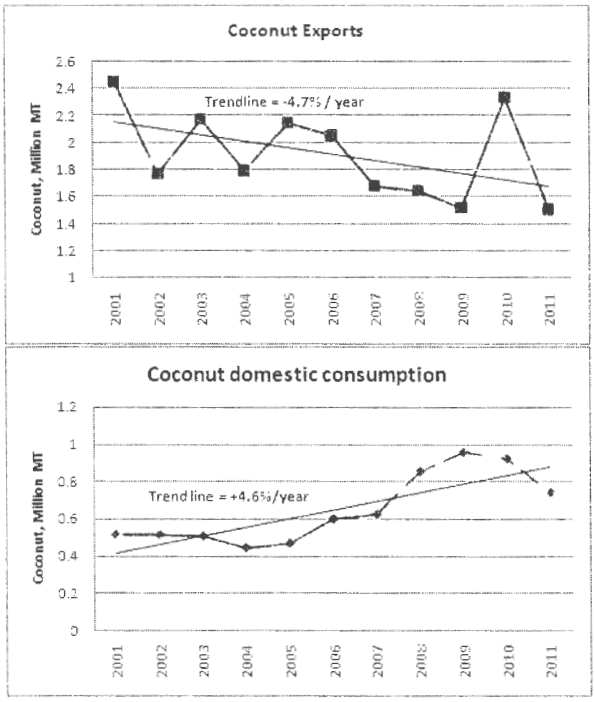


Figure 5. Trends in coconut exports and domestic consumption during the period 2001-2011 (UCAP).

At the farm level, a major barrier to higher productivity is the low yield of 43 nuts per tree per year. The Philippine Coconut Authority has been recommending replanting with hybrids and a new synthetic variety which can increase this yield to 60–150 nuts per tree per year. This will raise the income of the coconut farmer substantially and increase the raw materials supply for industry. Unfortunately, the needed funds to undertake the replanting of new hybrid higher-yielding coconut trees have not been provided (Carpio 2013). In addition, as in the case of all crops, proper care and management will be needed from the farmer.

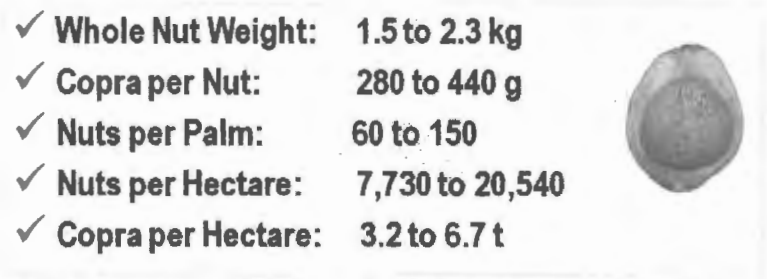


Figure 6. Performance of PCA synthetic hybrids. (Carpio 2013)

Raising Productivity in the Coconut Sector

Raising productivity in the coconut sector requires a multi-pronged approach involving social, economic and political measures, as well as technological interventions, at the farm level.

Any discussion of the coconut sector must start by addressing the heavy yoke that weighs down on its socio-economic and political condition. The coconut sector has had a long history— starting from the Spanish and American rule to the Marcos era—of being subjected to iniquitous conditions. (Romero Jr. 2008) The decrees and issuances during the Marcos rule essentially drew wealth from the coconut farmer and transferred this to the control of private individuals (Table 4).

The decision by the Philippine Supreme Court that the Coconut Levy Funds are "DECLARED OWNED BY THE GOVERNMENT TO BE USED ONLY FOR THE BENEFIT OF ALL COCONUT FARMERS AND FOR THE DEVELOPMENT OF THE COCONUT INDUSTRY" (Philippine Supreme Court 2012) gives the coconut sector, from the farmers to the industry, the opportunity to address the objectives of inclusive growth and competitive industrial growth.

Table 4. Decrees and issuances affecting the coconut farmer during the Marcos rule. (Romero Jr. 2013)

DECREE/ ISSUANCES, DATE	PURPOSE	EFFECT
RA 6260 June 19, 1971	To impose a levy of to create Coconut Industry Fund (CIF)	Forced savings for farmers (P0.55 / 100 kilos)
PD 323 June 30, 1973	To create the Philippine Coconut Authority (PCA). PCA to take over collection of the CIF levy.	Effectively places Cocofed and political allies in control of the coconut industry
PD 276 August 20, 1973	To establish the Coconut Consumers Stabilization Fund (CCSF); fund to be used to subsidize the sale of coconut-based products.	Imposed first big levy: P15/100 kilos
PD 414 April 18, 1974	CCSF made a permanent fund and expanded to include capital for investment; empower PCA to set the amount of the levy.	Levy collection extended indefinitely
PD 582 Nov 14, 1974	Create another fund: the Coconut Industry Development Fund (CIDF) to "finance the establishment, operation and maintenance of a hybrid coconut seed-nut farm... and the implementation of a nationwide coconut replanting program"	Development of Bugsuk Island seed garden out of CIDF which was turned over to a private entity; effectively created monopoly in the supply of hybrid seeds.
PD 755 July 29, 1975	PCA to acquire UCPB, CCSF collections deposited interest-free, with said bank	The First United Bank (FUB) is acquired by the PCA using the CCSF. It was renamed United Coconut Planters Bank and was turned over to private individual to manage and control.
PD 961 Oct 21, 1976	Create the Coconut Industry Investment Fund (CIIF), to be administered by the UCPB, to acquire shares of stock in coconut industry-related companies.	UCPB used the CIIF to acquire the country's biggest coconut oil mills creating the Unicom and Cocochem monopolies.
PD 1468 June 11, 1978	To revise Coconut Industry Code; shift the burden of the levy to copra exporters, oil millers, desiccators and other end-users	Levy collection entrusted to UNICOM and monopolies. Funds are now exempted from COA audit.
LOI 926 Sept 3, 1979	UCPB was directed to invest the CIIF in a private corporation which would serve as the instrument to pool and coordinate the resources of the coco farmers and oil millers in the buying.	Coconut established. Unicom monosopny/monopoly created.
EO 825 Aug 27, 1982	Coconut levy collections officially stopped	Levy collection unofficially collected by processors.
UCPB Resolution Aug 9, 1983	Acquisition of additional oil mills	Absolute monopoly of CNO supply.
UCPB Resolution Dec 15, 1983	Acquisition of SMC shares	Diverts levy funds from coconut development.

Copra is a technology that was developed in the 1860s to enable the shipment of raw coconut to northern Europe for edible fat and oil processing. The export of copra continued during the American period. The preparation of copra entailed breaking open the nut, removing the meat, and drying usually under the sun or in a heated enclosure. Unfortunately, because the wet meat is an excellent medium for microbial growth, exposure to the environment is certain to result in microbial contamination and poor meat quality. Even as early as 1931, the primitive methods of copra production had already been noted (Figure 7) (Hipp 1931). The same methods of copra production have remained virtually unchanged until today, almost 150 years after it was first introduced.

Philippine Copra and Coconut Oil

Copra Production Methods Remain Primitive, Although Modern Machinery Has Been Applied in Crushing Plants

By George W. Hipp*

Figure 7. A clipping from a 1931 issue of *Oil and Fat Industries*: Philippine copra production methods were considered primitive even during the 1930s. (Hipp 1931)

Produced at farm level using crude technologies, copra has many well-known problems, which have remained unsolved. Aside from the problem of fungal contamination which produces aflatoxin, the extracted oil is yellowish. Even the pure fatty acids produced from copra oil that has been refined and bleached (cochin) retain trace amounts of impurities which result in colored products which lower its value (Patiño 2013).

The shift away from copra towards integrated processing will enable full processing of the coconut and higher quality of product (Figure 8). However,

this will require larger investments in processing centers which should be strategically located for cheaper transport of coconuts from the farm, as well as transport to downstream factories. The costs of transport and logistics have to be considered.

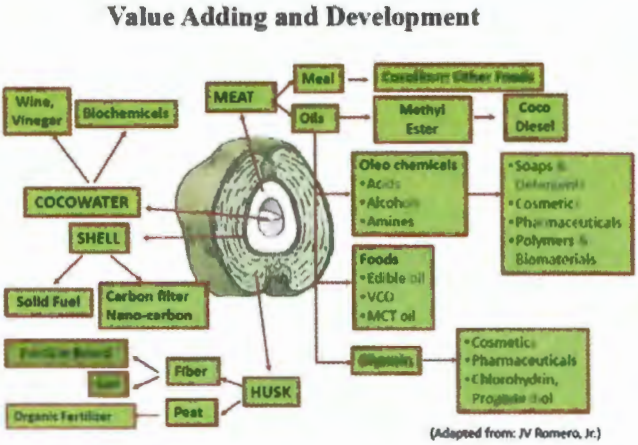


Figure 8. A shift away from copra towards a comprehensive processing of all components of the coconut will maximize value-added products.

The coconut sector must expand its vision of itself as a single commodity anchored on copra alone. Jose V. Romero Jr., the former Chairman of the Philippine Coconut Authority during Corazon Aquino's presidency, proposed that the Coconut industry should diversify *horizontally* by effective intercropping and integrate *vertically* by improving upstream raw material production and downstream high-value products. (Figure 9) The vertical integration of the coconut industry will link the agricultural and manufacturing sectors and strengthen the country as a whole. At the center of these efforts of vertical integration and horizontal diversification is the coconut farmer.

Romero Jr. (2013) proposed a strategy for inclusive growth for the Coconut industry, which includes the following:

- Promote higher levels of productivity, income and employment in the farms;
- Copra culture must now be complemented with the fresh coconut technology to effect a full value recovery of the coconut;

- The coconut-based farm system (CBFS) should adopt horizontal and vertical farm integration for the full utilization of the coconut. This will enhance the total factor productivity (TFP), (land, man, and capital);
- Cooperative marketing associations or marketing boards must be implemented in order to put producers on bargaining equality with consumers and remove the circuitous marketing structure of the industry sector;
- Provide government support services (e.g., infrastructure, technical and educational extension services, public credit agencies); and
- Promote an efficient input/output delivery system through adequate storage and transport facilities.

Achieving these measures will require coordination among several agencies of government, the private sector, the local communities, and the farmers. A number of coconut federations and industry groups have proposed that the Coco Levy Funds be used for the revitalization of the Coconut sector.

Achieving Global Competitiveness in Oleochemicals

The Coconut Industry can be grouped into three major sub-sectors: coco chemicals, biofuels, and food and health. Each sub-sector has its own needs and dynamics. Although the cocochemicals sub-sector shares some overlaps with the biofuels sector, the external conditions that drive demand for coco chemicals and coco biofuels are different. In particular, the demand for biofuels is driven by the Biofuels Act of 2006, which mandates the use of coco methyl esters (CME). If the mandated biofuel content of diesel is raised to 5% (B5), this will mean a CME demand of 350 M liters per year (Lao 2013).

The diversity of the products from the coconut can also be exploited to encourage the development of small and medium enterprises (SMEs). However, the development of SMEs requires support from the government in terms of product and market development, technology transfer and assistance, and financing.

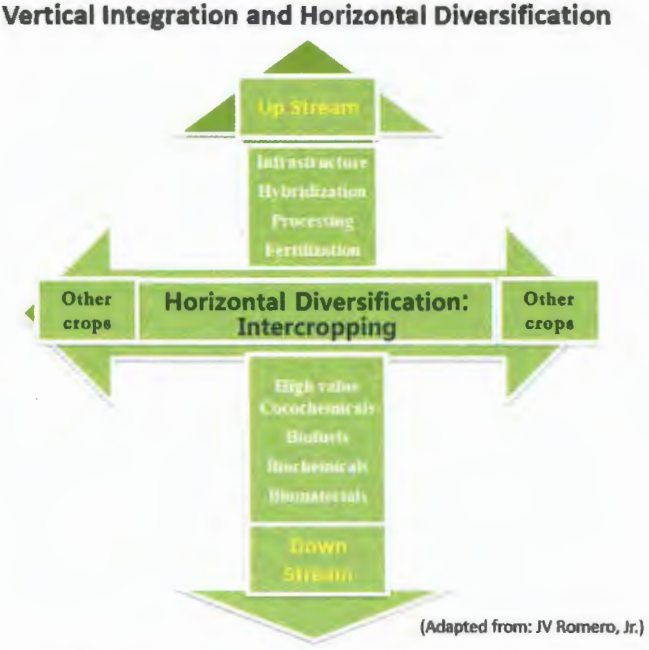


Figure 9. Vertical integration and horizontal diversification of the coconut industry. (Romero Jr. 2013)

Because of its carbon chain distribution which contains around 50% lauric acid (C12) and 65% medium chain (C6–C12), CME is the best-suited biofuel additive for diesel fuel (Figure 10) (Lao 2013). Lauric-based fatty acids and fatty alcohols are the preferred raw materials for cosmetics and personal care products, as well as soaps and detergents. PCA has developed a number of coconut hybrids, which have significantly higher lauric acid content (Carprio 2013; Laureles 2002).

Although coconut oil and palm kernel oil (PKO) have roughly the same fatty acid composition, the relative distribution of fatty acids gives coconut oil higher value than PKO. In particular, coconut oil has a higher percentage of the most expensive C6 – C10 and C12 fractions, while having a smaller proportion of the cheaper fraction of fatty acids C16 and longer (Table 5).

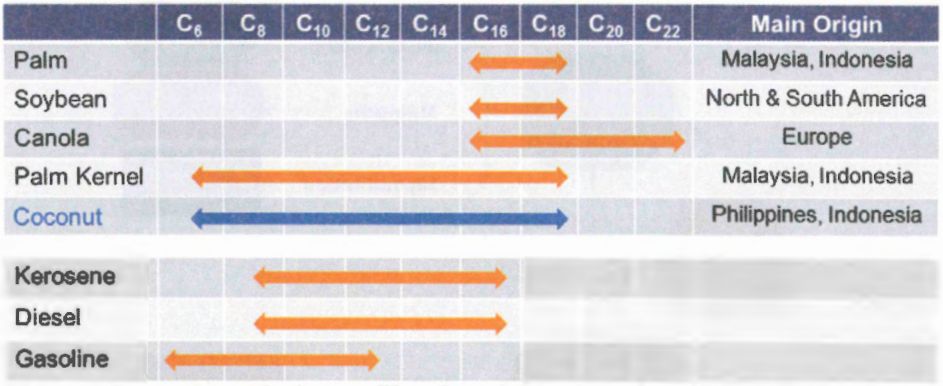


Figure 10. Carbon chain profile of various vegetable oils in comparison to fuels. Coconut oil and palm kernel oil are the best-matched biofuels for diesel. (Lao 2013)

Table 5. Coconut oil has higher value than palm kernel oil. (Patiño 2013)

Carbon Chain	Coconut	%	PKO	%	Value ($/MT)
C6	0.6		0.3		
C8	7.2	13.1	4.4	8.4	$2000
C10	5.9		3.7		
C12	47.9	66.5	48.4	64.0	$1250
C14	18.6		15.6		
C16	9.0		7.8		
C18:0	2.2	19.8	2.0	27.6	$1200
C18:1	7.0		15.1		
C18:2	1.6		2.7		

The basic steps in the production process of cocochemicals include splitting (hydrolysis) of the coconut oil to yield the fatty acids and crude glycerin. The fatty acids can be hydrogenated to fatty alcohols, methylated to yield the coconut methyl esters, or saponified to yield soap noodles. The crude glycerin is further distilled and bleached, if necessary, to yield refined glycerin (Figure 11). Bleaching is required to remove color if the raw material is cochin.

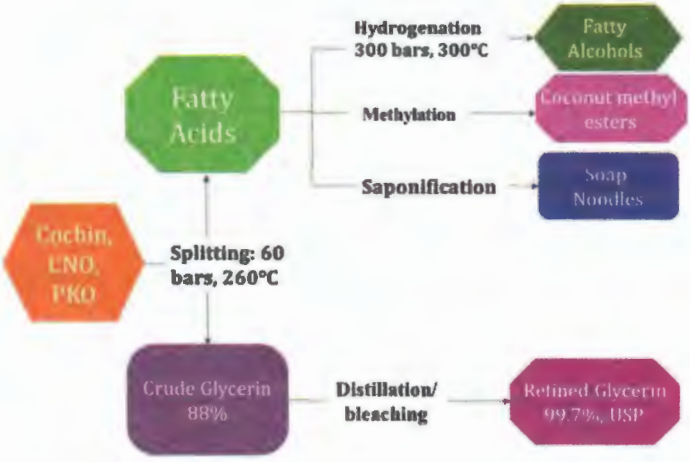


Figure 11. Overview of basic coco chemical products. (Patiño 2013; Lao 2013)

The value-adding processes for fatty acids and methyl esters include: fractionation (Figure 12), distillation, amidation, hydrogenation, ethoxylation, sulfonation, saponification, and amination (Lao 2013). These processes yield a diverse range of products as shown in Table 6.

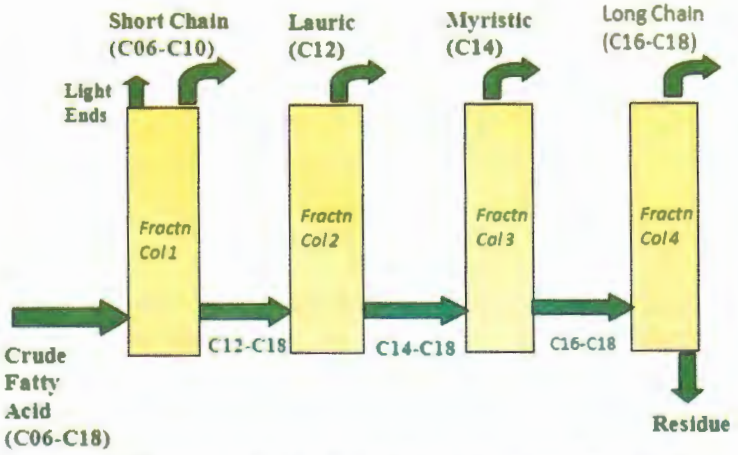


Figure 12. Fractionation of crude coco fatty acids. (Patiño 2013)

Glycerin

One of the major byproducts from the splitting of coconut oil is glycerin. Glycerin accounts for about 10% of the weight of coconut oil. For every kilogram of coconut oil that is split (hydrolyzed) to free the fatty acids, about 100 grams of glycerol is also produced. If the CME composition of biofuels is raised, this will result in the production of a large amount of glycerin. The estimated current production of glycerin ranges from 15,000 to 37,500 MT per year with an anticipated increase to 6 million MT by 2020 from coco biodiesel production (Lao 2013).

Table 6. Value-adding processes for coco fatty acids and methyl esters and examples of products. (Patiño 2013; Lao 2013)

Process	Product or Application
Fractionation	Partial separation into fatty acids or fatty methyl esters; C8 and C10 for MCT oil.
Distillation	Pure fatty acids or fatty methyl esters
Amidation	• Amides for use as non-ionic surfactant • Cocoamidopropyl betaine: special surfactant used for its foam property and solubility.
Hydrogenation	Fatty alcohols: chemical intermediates
Ethoxylation	Non-ionic surfactants, wetting agents, emulsifier, foam boosters, humectants
Sulfonation	Coconut fatty alcohol sulfate: biodegradable detergent
Saponification	Soaps
Amination	Cationic surfactants: shampoos, specialty soaps
Esterification	• Reaction with glycerol: medium chain triglycerides (MCT oil) for medical and nutritional use; monolaurin • Reaction with various alcohols: plasticizers
Quaternization	• Dispersants, corrosion inhibitors, cationic surfactants • Ester quats are a family of cationic compounds used in fabric softeners and hair conditioners.
Amidation and Sulfonation	Sodium methyl cocoyl taurate: an anionic surfactant used is in specialty foaming face cleansing formulations.

Glycerin is a significant by-product that can be developed for various high-value applications. Currently, crude glycerin is being exported for further refining. The switch from copra to an integrated wet process will improve the quality of crude glycerin which will make bleaching unnecessary (Patiño 2013). New uses of glycerin must be developed to avoid price erosion. The profile of glycerin is summarized in Table 7.

Table 7. Profile of glycerin: opportunities for converting a byproduct into a high-value product (Patiño 2013; Lao 2013)

Glycerin Supply

- Global natural glycerin capacity is estimated at 3.7 Million MT.
- Current Philippine production is 15,000 to 37,500 MT per year of crude glycerin
- Substantial increase to 6 million MT by 2020 from biodiesel production
- Premium on Coco-Glycerin from sustainable source

Current Uses of Glycerin

- Crude Philippine glycerin is exported and converted into refined glycerin and other value-added products
- Food products
- Cosmetics
- Pharmaceuticals
- Resin intermediate

Potential Uses of Glycerin

- Animal feed and nutrition
- Biomethanol
- Replacement for petrochemical intermediates, such as propylene glycol and epichlorohydrin

Coco Chemicals

The coconut industry can increase the value of its products by improving its processing (e.g., shifting away from copra) and by going into value-added products. "Value added products" refers to the increase in the value of a

product over the value of the materials used to produce it. This can be achieved by improvements from further processing or conversion into a more useful product. Value addition generally increases profit. For example, the shift from the copra process to an integrated wet process will improve the quality of its products which will in turn fetch a higher price (Table 8). Value-added processing will fetch higher prices for the product (Table 9).

Table 8. Comparison of palm kernel oil, cochin and crude coconut oil: higher quality products command a higher price. (Patiño 2013)

Product	Price ($/MT)
Heat stable C8-10 fraction from palm kernel oil	2,400
"Heat stable" C8-10 fraction from refined, bleached coconut oil from copra (cochin)	1,800
Undistilled C8-10 fraction from crude coconut oil	1,300

Table 9. Comparison of various coconut products: value-added processing raises the price of a product. (Patiño 2013)

Product	Value-Added Processing	Price ($/MT)
Crude coconut oil	None	830
Short chain acids	fractional distillation	2,000
Myristic Acid	fractional distillation	2,200
Isopropyl Myristate	fractional distillation and esterification	3,900
MCT (cosmetic grade)	fractional distillation and esterification	3,250
MCT (food/kosher)	fractional distillation and esterification	3,300

The main competitors of the Philippine coco chemical industry for global markets are Malaysia's and Indonesia's palm oil industries and Indonesia's

coconut oil industry. Malaysia and Indonesia supply a bigger share of the global markets of fatty acids and fatty alcohols and generally produce superior oleochemical products compared to the copra-sourced Philippine cocochemical products. Price-wise, Malaysia and Indonesia are able to sell more competitively because their oleochemical industry is vertically integrated from farm to chemical factory. In addition, Malaysia and Indonesia encourage domestic production through an export tax scheme which makes domestic prices of oils cheaper (Table 10) (Patiño 2013; Lao 2013).

Table 10. Comparison of Malaysian and Indonesian oleochemicals industries versus the Philippine cocochemical Industry. (Patiño 2013; Lao 2013)

- The Malaysian and Indonesian oleochemicals industries are vertically integrated producers.
- The Malaysian and Indonesian oleochemicals industries have larger installed capacities than the Philippine cocochemical industry.
- Fatty acids produced from palm or palm kernel oil have superior color properties over fatty acids produced from copra-sourced coconut oil.
- Indonesia and Malaysia provide export tax.
- PKO sells at a lower price than coconut oil.
- Foreign partners with downstream technology unwilling to invest in the Philippines due to absence of long-term plan for increasing coconut production.

Another source of strength of Malaysia palm oil is the strong forward-looking vision of the Malaysian Palm Oil Board: "To become the premier Nobel Laureate – producing research and development institution, providing leadership and impetus for the development of a highly diversified, value-added, globally competitive and sustainable oil palm industry." (MPOB website) This science-based strategy has pushed palm oil far ahead of coconut oil. Indeed, over the past 25 years, the Palm Oil Research Institute of Malaysia has produced many products and innovations on palm oil and has funded numerous researches in partner laboratories overseas to promote the science of palm oil. Unfortunately, the Philippine coconut industry has no institute or research program that can compare with this.

Despite the strength and efficiency of palm oil, it has a strong negative image particularly in the U.S. and Europe because of the massive conversion of forests into palm plantations (Figure 13). In contrast, the image of coconut is generally positive.

Figure 13. Palm oil has a negative image in the West due to the massive conversion of forest land into palm oil plantations.
(http://wwf.panda.org/what_we_do/footprint/agriculture/palm_oil/environmental_impacts/biodversity_loss/)

Status of the Coco Chemical Companies

In 2008, United Coconut Chemicals, Inc. (Cocochem) established the Cocochem Agro-Industrial Park Special Economic Zone (CAIP), a 42-hectare special economic zone dedicated to processing coconut oil to higher-value products. It is located in San Pascual, Batangas, and was built especially for coconut oil and palm oil based companies. Unfortunately, on June 18, 2012, the board of Cocochem made the decision to shut down the plant "indefinitely" after nearly 30 years of operation, due to mismanagement, in particular during the years 2005 to 2010, including the failure to undertake necessary plant maintenance and equipment upgrades

(PDI, June 11, 2013). This closure has dealt a blow to the ability of the Philippines to industrialize the cocochemical sector and go into high value products. It is hoped that Cocochem will be able to address these issues and reopen soon. The list of major companies belonging to the Philippine cocochemical industry has been depleted by a number of closures (Table 11).

Table 11. Members of the Philippine Oleochemical Manufacturers Association (POMA). POMA is composed of producers and exporters of intermediate chemicals from coconut oil, such as coco fatty alcohols, coco methyl esters, coco fatty acids, glycerin, and coco amides. This list does not include companies in the coconut food industry. (Patiño 2013; UCAP 2013)

Company	Status
Chemrez Technologies, Inc.	Diversified Producer: resins, colorants, oleochemicals, glycerin, coconut methyl esters
JNJ Oleochemicals, Inc.	Produces coco methyl esters, coco fatty alcohols, crude glycerin, coco amines.
Pan Century Surfactants, Inc.	Shutdown
Pilipinas Kao, Inc.	A Japanese company engaged in manufacture of household and personal products, such as cosmetics, soaps and detergents.
Sakamoto Orient Chemicals Corp.	A Japanese company engaged in the refining of crude glycerin to refined glycerin, downstream production of polyglycerin and flame retardants for export to Japan.
United Coconut Chemicals, Inc.	Shut down. Cocochem was the top oleochemical supplier of the domestic market. Main products included: coco fatty acids, coco fatty alcohols, refined glycerin, and soap noodles.
Stepan Philippines	A U.S. company engaged in processing fatty alcohols to surfactants and fatty acids to ester quats for personal care products. (Not a member of POMA)

Integrating the Value Chain

One of the major weaknesses of the coco chemical industry – which is one of the strengths of our Malaysian and Indonesian counterparts – is the absence of a value chain that links the production of raw materials (coconut oil) with manufacturing, product development, and marketing. A stable and sufficient supply of coconut oil is necessary for the industry to be competitive. Vertical integration – from the supply of raw materials, to manufacture, product development and marketing – creates more value for all (Figure 14).

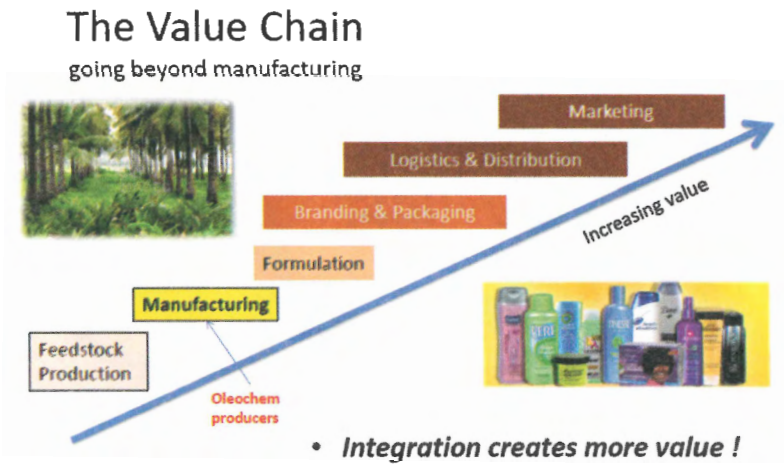


Figure 14. Integrating the value chain will make the oleochemicals industry more competitive. (Lao 2013)

Emerging Applications for Oleochemicals

The global oleochemicals industry is a dynamic industry that has a stable market for its existing applications but still has a number of promising emerging applications, in particular in the following: (Figure 15)

- Biolubricants: Because machine lubricants are often lost in the environment through leaks, etc., there is a market for environmentally-compatible lubricants or lubricant additives.
- Green Chemicals: There is a demand to replace petroleum inputs in paints, coatings, adhesives, and other products.

- Biopolymers: There is an emerging demand for biocompatible materials for medical and biotechnology applications, such as medical devices, tissue engineering, and drug delivery.
- Bioplastics: Coco chemicals can be developed into biodegradable plastics for use in packaging, electronics products, agriculture, and others.

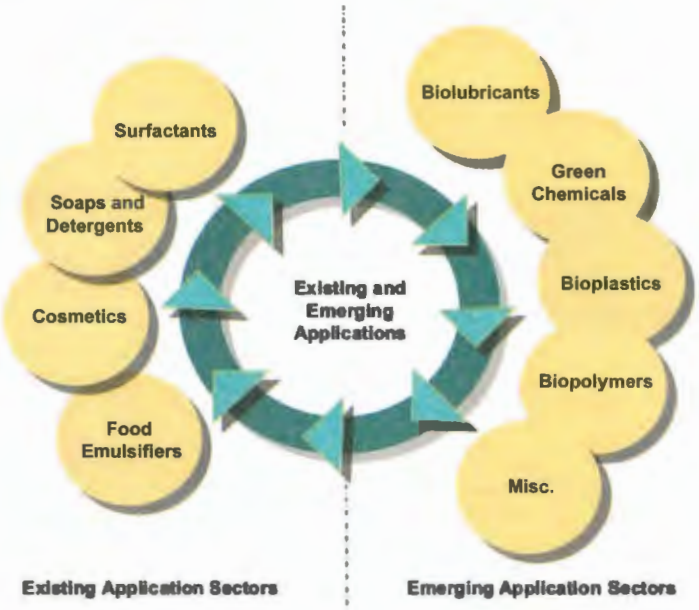


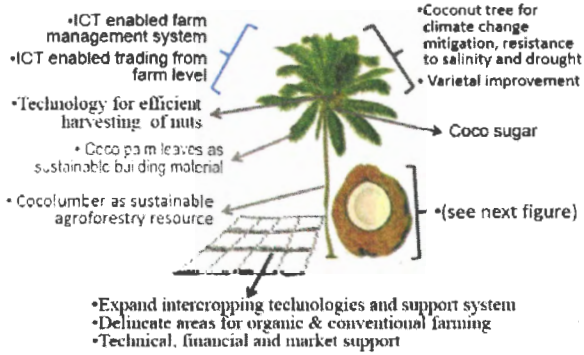
Figure 15. Emerging applications for oleochemicals. (Kee 2010)

The Integrated Coconut Farm: Horizontal and Vertical Integration

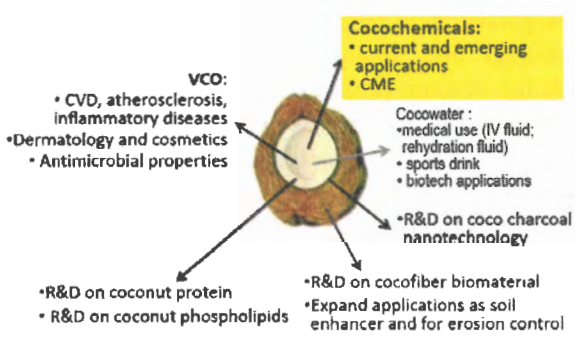
The premise of this paper is that the coconut is a unique agricultural resource that can be developed through both horizontal and vertical integration. Production efficiency on the farm can be improved using ICT. Horizontal integration can be strengthened by expanding intercropping technologies. This will require technical, financial and market support.

Figures 16a and b illustrate the wide range of traditional and modern products that can be obtained from the coconut. It is worth mentioning here that this paper has focused on only one of the products: coconut oil.

a.



b.



Figures 16a and 16b. The range of traditional and modern uses of the coconut industry: horizontal and vertical integration. The coconut is truly the Tree of Life.

Crafting a Comprehensive Roadmap

There are several challenges for the entire Philippine coconut sector and a comprehensive roadmap is needed to address these: How can it be a vehicle for inclusive growth? How can we revive our cocochemical industry? How can we make it globally competitive? The following points summarize the presentations and discussions from the NAST roundtable sessions on Inclusive Growth and the Coco Chemical Industry.

The strategy for the Philippine coconut industry must be comprehensive and must consider the following:

1. The Philippine Supreme Court has ruled that the Coco Levy Funds are owned by the government and can be "used only for the benefit of all Coconut Farmers and for the Development of the Coconut Industry"

2. At the level of the coconut farmer:
   - The social, economic, political, and historic dimensions of the coconut industry must be understood from the perspective of the coconut farmers, and tangible benefits must accrue to the coconut farmers.
   - Massive effort to replace senile and non-productive coconut trees with better high-yielding and disease-resistant varieties.
   - Introduce science- based farm management system with appropriate technologies
   - Technical and financial assistance for coconut-based inter-cropping system; promote horizontal integration.
   - Mitigate wide fluctuations in coconut prices.
   - Provide education and health care for the coconut farmer and his family.

3. At the local level:
   - Development of SMEs that can create products from the other parts of the coconut. This can harness the skills and provide jobs for moderately skilled workers and drive inclusive economic growth. This will require assistance in terms of product and market development, technical assistance and financing.

4. At the level of the oil mills and processors:
   - Phase-out of the copra process in favor of a process that makes use of all the parts of the coconut; development of more efficient processing technologies.
   - Provide financing for technological upgrades.
   - Expand the coconut-related SME sector.

5. For the coco chemical industry:
   - Sustainability and environmental protection should be built into the design of the coconut industry as this is an important selling point for consumers.

- Improve industry-wide coordination to enable vertical integration and supply-chain.
- Focus on the higher demand for medium chain triglycerides for cosmetic preparations and health/nutritional formulations.
- More product development is needed to realize the higher value due to the favorable carbon chain distribution of coconut oil.
- Provide fiscal incentives for Coconut Industrial Estates, especially in Mindanao where the majority of our coconut trees are.
- There is a need to expand to reach economies of scale.
- Coco-biodiesel now forms the foundation of the oleochemical industry due to the Biofuels Act of 2006. This will continue to grow based on the mandated use of coco-biodiesel.
- Local R&D should be developed for oleochemicals and glycerin.
- Improvements can be realized through improved logistics, lower power costs, and an executable Master plan.

6. Government intervention and support:
   - Strategic utilization of Coco Levy Fund that will benefit the coconut farmers and support the industrialization of the sector.
   - The coconut replanting program should be accelerated.
   - The government should secure favorable conditions in international trade.

7. Coconut R&D:
   - R&D should be linked to the needs of the coconut industry, including both upstream and downstream processes (vertical integration).
   - Particular concern should be focused on the areas of genetics, agronomy, plant pathology, entomology, chemistry, and chemical and industrial engineering. Explore the use of IT to enhance efficiencies at all levels of the coconut industry and to enhance vertical integration.
   - R&D directions should be industry-led and coordinated through an appropriate Coconut Research Council to be created for this purpose.

- R&D to investigate the optimal utilization of *all* parts of the coconut which will provide maximum benefit to the farmer and support a competitive industry

8. Education:
   - Develop focused coconut education and vocational-technical programs for grades 11-12 in coconut-producing provinces.
   - Develop academic programs which support the coconut industry. These should include science and engineering programs, as well as sociology, economics and finance, and political science programs. This development can be coordinated through the creation of a CHED Technical Panel on the Coconut Industry.

Because of the breadth and complexity of the entire coconut industry, an appropriate multi-sectoral body should be formed to oversee the developments and coordinate strategies.

The Coconut Industry is probably the best opportunity for the administration of Pres. Benigno Aquino to create productive jobs and reduce poverty on a massive scale, to develop a globally competitive sector, and to attain inclusive growth that is sustainable. No other administration has achieved these.

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